DOCUMENT RESUME

ED 259 879 SE 045 290

AUTHOR	Iozzi, Louis A., Ed.
TITLE	Summary of Research in Environmental Education, 1971-1982. Monographs in Environmental Education and Environmental Studies, Volume II.
INSTITUTION	ERIC Clearinghouse for Science, Mathematics, and Environmental Education, Columbus, Ohio.; North American Association for Environmental Education, Troy, OH.
SPONS AGENCY	National Inst. of Education (ED), Washington, DC.
PUB DATE	Dec 84
CONTRACT	400-78-0004
NOTE	159p.; For volume I of this document, see ED 251 293. For the 429 abstracts synthesized in volume II, see ED 214 762.
AVAILABLE FROM	SMEAC Information Reference Center, The Ohio State University, 1200 Chambers Road, 3rd Floor, Columbus, OH 43212 ($17.25).
PUB TYPE	Information Analyses - ERIC Information Analysis Products (071) -- Reports - Descriptive (141) -- Collected Works - General (020)
EDRS PRICE	MF01/PC07 Plus Postage.
DESCRIPTORS	*Affective Behavior; Affective Measures; Attitudes; Continuing Education; *Ecology; Elementary Secondary Education; *Environmental Education; Higher Education; Literature Reviews; Problem Solving; Research Methodology; *Skill Development; Skills; *Teacher Education; Values
IDENTIFIERS	*Environmental Education Research; *Environmental Issues

ABSTRACT

Summaries of environmental education (EE) research studies conducted during the 12-year period 1971-1982 are presented in this seven-chapter publication. These chapters are: (1) "Environmental Education Research, 1971-1982--Overview" (by Louis Iozzi); (2) "Environmental Education Research Related to Ecological Foundations" (by Thomas Marcinkowski), which includes 39 studies dealing with attributes of and educational resources for ecological literacy; (3) "Environmental Education Research Related to the Affective Domain" (by Lisa Specca and Louis Iozzi); (4) "Environmental Education Research Related to Issue Awareness" (by Randall Wiesenmayer, Maureen Murrin, and Audrey Tomera), examining only studies that explored cognitive aspects of public awareness about environmental issues; (5) "Environmental Education Research Related to Issue Investigation and Evaluation Skills" (by Peter Bastardo, Arthur Edwards, and Louis Iozzi); (6) "Environmental Education Research Related to Environmental Action Skills" (by Jody Hines and Harold Hungerford), examining studies dealing with the development and applications of the skills necessary for individuals to take responsible environmental action; and (7) "Environmental Education Research Related to Teacher Training" (by R. Ben Peyton), which includes the analysis of 19 relevant studies. (JN)

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SUMMARY OF RESEARCH
IN ENVIRONMENTAL EDUCATION, 1971-1982

MONOGRAPHS IN ENVIRONMENTAL EDUCATION AND ENVIRONMENTAL STUDIES, VOLUME II

edited by Louis A. Iozzi

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December, 1984

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Environmental Education Information Reports

Environmental Education Information Reports are issued to analyze and summarize information related to the teaching and learning of environmental education. It is hoped that these reviews will provide information for personnel involved in development, ideas for teachers, and indications of trends in environmental education.

Your comments and suggestions for this series are invited.

John F. Disinger
Associate Director
Environmental Education
ERIC/SMEAC

This publication was prepared with funding from the National Institute of Education, U.S. Department of Education under contract no. 400-78-0004. The opinions expressed in this report do not necessarily reflect the positions or policies of NIE or U.S. Department of Education.

PREFACE

The National Commission on Environmental Education Research (NCEER) was established in 1980 as a result of initiatives taken by A. Clay Schoenfeld, professor of journalism at the University of Wisconsin-Madison while serving as President of the National Association for Environmental Education (NAEE). Professor Schoenfeld perceived the need for researchers in the field of Environmental Education (EE) to gather and examine the rapidly growing body of EE research conducted over the past decade or so, to organize and synthesize that body of information, and to make suggestions and recommendations to help guide future research. The creation of the NCEER was Professor Schoenfeld's response to that need. I have been privileged to serve as chairman of the NCEER since shortly after its inception in 1980; Dr. Lei Lane Burrus-Bammel of West Virginia University was the initial chair. The NCEER is now a "standing committee" of the NAEE responsible for "research and evaluation" activities of the Association (now known as the North American Association for Environmental Education).

Over the past four years, the NCEER has been actively involved in carrying out the tasks assigned by Professor Schoenfeld. The first product generated by the NCEER was Research in Environmental Education, 1971-1980, a volume of 429 abstracts of EE research conducted between 1971 and 1980. The abstracts were developed from research documents found in professional journals, doctoral dissertations, and fugitive literature as reported through the ERIC system. To our knowledge, Research in Environmental Education, 1971-1980, is the most comprehensive and most up-to-date document of its kind available. With the publication of that volume, Phase I of the NCEER's work was completed.

Almost immediately upon completion of Research in Environmental Education, 1971-1980, the NCEER began working on Phase II of the project - a synthesis of EE research and recommendations for further research. The commission, very early in Phase II of the project, decided to include two additional years of research studies (1981 and 1982) in an attempt to make the second phase of its work as current as possible. Hence, this - the second volume completed by the NCEER - includes studies conducted between 1971 and 1982, a period of twelve years.

The NCEER adapted the framework for Environmental Education curriculum and planning proposed by Hungerford, Peyton, and Wilke[1] to serve as a structure for grouping the research studies into meaningful sections and then into a coherent "whole." As a result, this volume is divided into five chapters which correspond to the Hungerford, et al., schema (chapter 2-6) and two additional chapters (chapters 1 and 7) which the commission felt were necessary to present the complete "story".

---

[1] Hungerford, Harold R., R. Ben Peyton, and Richard J. Wilke, "A Framework for Environmental Education Curriculum Planning and Development." In A. B. Sacks et al. (eds.), Current Issues VI: The Yearbook of Environmental Education and Environmental Studies, pp. 202-217. Columbus, OH: ERIC/SMEAC, 1980.

Thus:

Chapter 1: Environmental Education Research - Overview

Chapter 2: Environmental Education Research Related to Ecological Foundations

Chapter 3. Environmental Education Research Related to the Affective Domain

Chapter 4: Environmental Education Research Related to Issue Awareness

Chapter 5: Environmental Education Research Related to Investigation and Evaluation Skills

Chapter 6: Environmental Education Research Related to Environmental Action Skills

Chapter 7: Environmental Education Research Related to Teacher Training

Many of the studies appearing in this volume dealt with more than one EE topic or issue. Hence, the reader should not be surprised to see the same study mentioned, or cited, in several chapters of this book. In these cases, however, different aspects of the same studies are discussed in different contexts - depending on the focus of the chapter.

Although each chapter was written by a different author or team of authors, I was solely responsible for editing the work of all contributors. In some cases editing was minor and in other cases it was more extensive. Hopefully I did not distort too much what the various authors intended to say. In any case, as editor I take full responsibility for any errors, omissions, or distortions that may appear in this volume.

As with any task requiring so long to complete, many people deserve thanks and acknowledgement. At the risk of offending some by omission, I feel compelled to recognize and thank the following:

Professor A. Clay Schoenfeld for the wisdom, foresight and initiative to get this project started.

Dr. Lei Lane Burrus-Bammel for her early leadership efforts in helping this project "get off the ground."

Dr. Craig B. Davis for his continued support and encouragement while president of the NAEE and through the duration of the project.

Dr. William B. Stapp for supporting our work during his presidency of the NAEE.

Dr. Arthur B. Sacks for his guidance while chairing the NAEE Publications Committee and while serving as president.

Dr. Robert W. Howe and the staff of ERIC/SMEAC for their encouragement and assistance.

A *very* special thanks is owed to my friend Dr. John F. Disinger at ERIC/SMEAC for his encouragement, faith in the NCEER, and patience.

Both phases of the NCEER project and both volumes produced over the past four years were the results of the voluntary efforts of a team of extraordinary, talented, and highly competent EE researchers and academicians. These include the members of the NCEER:

Dr. Carl Bollwinkel
University of Northern Iowa

Dr. John Disinger
Ohio State University

Dr. Michael Gross
University of Wisconsin

Dr. Jody Hines
University of Northern Iowa

Dr. Harold Hungerford
Southern Illinois University

Dr. R. Ben Peyton
Michigan State University

Dr. Esther Railton
California State University-Hayward

Dr. Deborah Simmons
University of Michigan

Dr. Audrey Tomera
Southern Illinois University

Dr. Richard Wilke
University of Wisconsin-Steven Point

Also included in this group are the authors of this volume. To them my heartfelt thanks and congratulations for a job well done:

Dr. Peter J. Bastardo, New Jersey Department of Education

Dr. Arthur W. Edwards, Rutgers University

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Mr. Randall L. Wiesenmayer, Pennsylvania State University

Finally, if I may be so bold to take the liberty, it is to this great group of people - the NCEER and authors cited above - that I dedicate this volume.

Louis A. Iozzi, Ph.D.
Rutgers-The State University of New Jersey
Chairman, NCEER

New Brunswick, NJ
December 1984

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MISSION STATEMENT

The North American Association for Environmental Education (NAEE) is a professional association established to assist and support the work of individuals and groups engaged in environmental education, research, and service. In meeting the goals and needs of environmental professionals, NAEE promotes the analysis and understanding of environmental issues and questions as the basis for effective education, problem-solving, policy-making, and management.

Through its activities, NAEE seeks to foster (1) the education of skilled individuals able to understand environmental problems and possessing the expertise to devise effective solutions to them; and (2) development of a citizenry conscious of the scope and complexity of current and emerging environmental problems and supportive of solutions and policies which are ecologically sound:

NAEE is organized into three interactive sections each conducting specialized programs responsive to their members. These are:

- The Elementary and Secondary Education Section (ESES)
- The Environmental Studies Section (ESS)
- The Non-Formal Section (NFS)

Professionals within these sections address the following audiences:

- the general citizenry;
- the fellow educators at all educational levels;
- those who make or facilitate the making of major decisions affecting the environment (e.g. government officials, scientists, engineers, planners, lawyers, journalists and mass communicators); and
- environmental resources managers (e.g. foresters, water resources managers, wildlife managers, park managers)

NAEE maintains the following guiding principles. Environmental Education should:

- consider the environment in its **totality** — natural and built: biological and physical phenomena and their interrelations with social, economic, political, technological, cultural, historical, moral, and aesthetic aspects;
- **integrate knowledge** from the disciplines across the natural sciences, social sciences, and humanities;
- examine the scope and complexity of environmental problems and thus the need to develop **critical thinking** and **problem-solving** skills and the ability to synthesize data from many fields;
- develop **awareness and understanding of global problems, issues, and interdependence** — helping people to think globally and act locally;
- consider both short and long term **futures** on matters of local, national, regional and international importance;
- relate **environmental knowledge, problem-solving, values, and sensitivity** at every level;
- emphasize the role of **values, morality** and **ethics** in shaping attitudes and actions affecting the environment;
- stress the need for **active citizen participation** in solving environmental problems and preventing new ones;
- enable learners to play a role in **planning their learning experiences** and providing an opportunity for making decisions and accepting their consequences; and
- be a **life-long process** — should begin at a preschool level, continue throughout formal elementary, secondary, and post secondary levels, and utilize non-formal modes for all age and educational levels.

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Summary of Research in Environmental Education, 1971 - 1982

I. Environmental Education Research, 1971-1982

OVERVIEW

Louis A. Iozzi[1]

Each of the more than four hundred abstracts included in Research in Environmental Education, 1971-1980 (RIEE) and synthesized in this volume, were coded to at least three, and usually no more than seven or eight key descriptors. The National Commission on Environmental Education Research (NCEER) felt that the use of key descriptors would facilitate the use of RIEE and provide researchers with an effective way of accessing the information found in that publication. When looking for a body of available research, one needed only to scan the list of descriptors provided to determine which ones matched, or nearly matched the topic in which he or she was interested. Then, by simply turning to the appropriate section of RIEE and locating the selected descriptors, the number of all abstracts coded to that descriptor were listed.

A total of seventy-four descriptors grouped into ten categories were used in producing the RIEE during phase I of the NCEER long term project. The seventy-four descriptors and the ten categories into which they were grouped are shown in Table 1. Any conceivable piece of EE research can be accurately and meaningfully coded to one or more of the key descriptors included in Table 1.

Coding all the studies included in this project to the key descriptors also proved useful for gaining an overall assessment of the types of research conducted, methodologies employed, types of audiences studied, teaching methods emphasized, where EE was taught, types of topics/issues emphasized, and a whole array of useful information not touched on elsewhere in this volume.

The following sections of this chapter correspond to the ten categories into which the list of seventy-four descriptors have been grouped (Table 1). For example, "EE Goal Levels," "EE Facilities," "EE Learner Traits," and so on. This chapter, then, should provide a useful overview of the relative attention given to the variety of EE research over the past twelve or so years. No attempt was made in this chapter to assess the quality of the research - only the degree of relative activity (number of studies) for each of the descriptors within each group was examined. This approach provides useful information regarding which areas researchers were interested in as well as general areas needing greater attention in the future.

---

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Table 1: DESCRIPTORS FOR RESEARCH IN ENVIRONMENTAL EDUCATION (EE)

All of the entries appearing in this volume are coded to the following descriptors:

EE GOAL LEVELS
- ecology education
- issue awareness/knowledge of issues
- issue identification skills
- issue investigation/evaluation skills
- value clarification skills
- citizen action

EE FACILITIES
- outdoor classroom
- environmental center
- community resource

EDUCATION LEVEL
- elementary
- middle school
- secondary
- higher education
- continuing education
- teacher training inservice
- teacher training preservice

LEARNING DOMAIN
- cognitive
- affective
- psychomotor

NATURE OF THE STUDY
- program development
- program implementation
- program evaluation
- hypothesis generation
- model building
- instrument development

RESEARCH METHODS
- historical research
- experimental research
- descriptive research
- theoretical research
- pre-experimental research
- ex post facto research
- unobtrusive research

EE METHODS
- inquiry
- lecture
- field trip
- outdoor education
- individualized instruction
- games
- simulations
- case studies

EE CURRICULUM MODE
- interdisciplinary
- multidisciplinary - infusion
- formal
- nonformal

EE LEARNER TRAITS
- personality type
- cognitive style
- preferences
- educational background
- social background
- economic background
- urban
- rural
- citizenship
- ethnic group
- intelligence
- locus of control
- moral development
- attitudes
- beliefs
- values
- behaviors
- knowledge

EE CONTENT AREA
- population education
- issue-based
- energy education
- marine education
- science education
- social science education
- language arts
- mathematics education
- citizenship education
- resource management education
- outdoor education
- conservation education

EE Goal Levels

Hungerford, Peyton, and Wilke (131) developed and validated a series of Goals for Curriculum Development in Environmental Education. The goals, which compare favorably with the objectives for EE arising from the Tbilisi Conference, were grouped by the authors into four levels: (I) Ecological Foundations, (II) Conceptual Awareness-Issues and Values, (III) Investigation and Evaluation, and (IV) Environmental Action Skills-Training and Applications. The goal levels included as descriptors by the NCEER are direct outgrowths of the work of Hungerford, et al. (131).

The relative percentages of studies for each of the six EE Goal Levels utilized as descriptors for the project appear in Figure 1. It becomes quickly obvious that most of the research dealt with examining Goal Level II, Issue Awareness and/or Knowledge of Issues in various policies. Nearly half of the studies (48.3%) in this category dealt with this descriptor. Researchers also seemed to be somewhat interested in citizen action (16.7%), while the other goal levels received relatively little attention. Clearly, values and value clarification skill development failed to attract much attention.

EE Facilities

A number of studies investigated the use of a variety of facilities used for environmental education (Figure 2). As one might expect, slightly more than half of the studies dealt with the "outdoors" as the major area of interest of researchers. This might be a result of so many outdoor educators becoming involved in the EE movement quite early.

About 30 percent of the studies looked at EE taking place in the community and still fewer (18.9%) investigated the use of EE centers in some form or another. Again this seems logical in that much emphasis was placed on the interdisciplinary nature of EE and "going out into the community" to study the near surroundings. Simply, EE, it was said, did not have to take place in the "out-of-doors," in the "woods," or in the "country." Rather, EE could, and should, take place "anywhere you are."

While there was, during the early stages of EE, a major effort undertaken to establish EE centers, such efforts met with only moderate success. Many of those which were, in fact, experienced financial difficulties and were forced to close within relatively short periods of time. Hence, EE centers did not seem to be a major area of concern for researchers. Only about 10 studies of over 500 dealt with this topic.

Education Levels

This category was included to try to determine the grade level(s) at which most of the studies were conducted. It is often a good indicator of where most of the activity in EE was taking place as well.

The greatest number of studies looked at EE at the secondary school level (27.9%) followed by the middle/junior high school level (15.7%) and the elementary school (15.7%) (Figure 3).

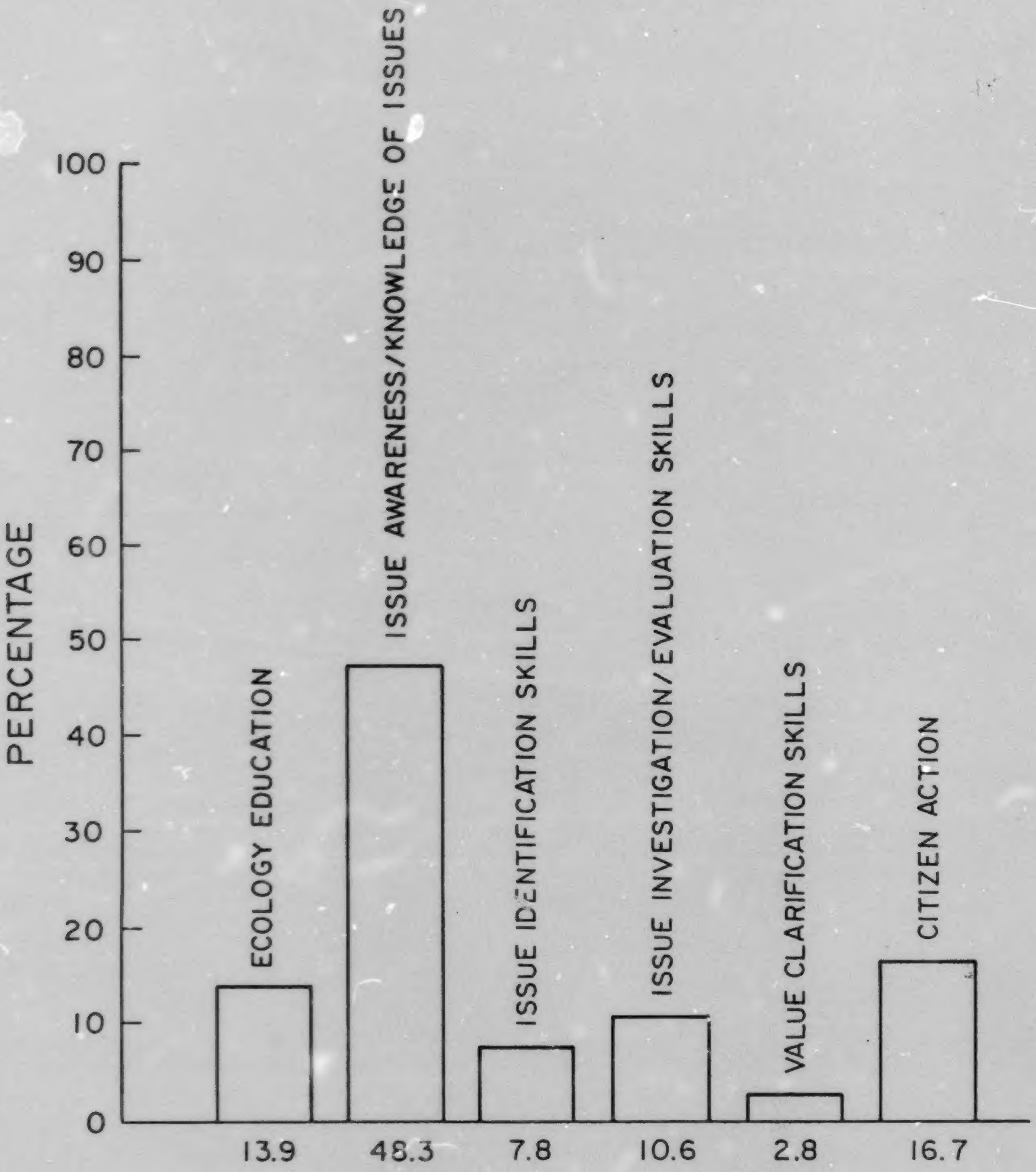

Figure 1: ENVIRONMENTAL EDUCATION GOAL LEVELS

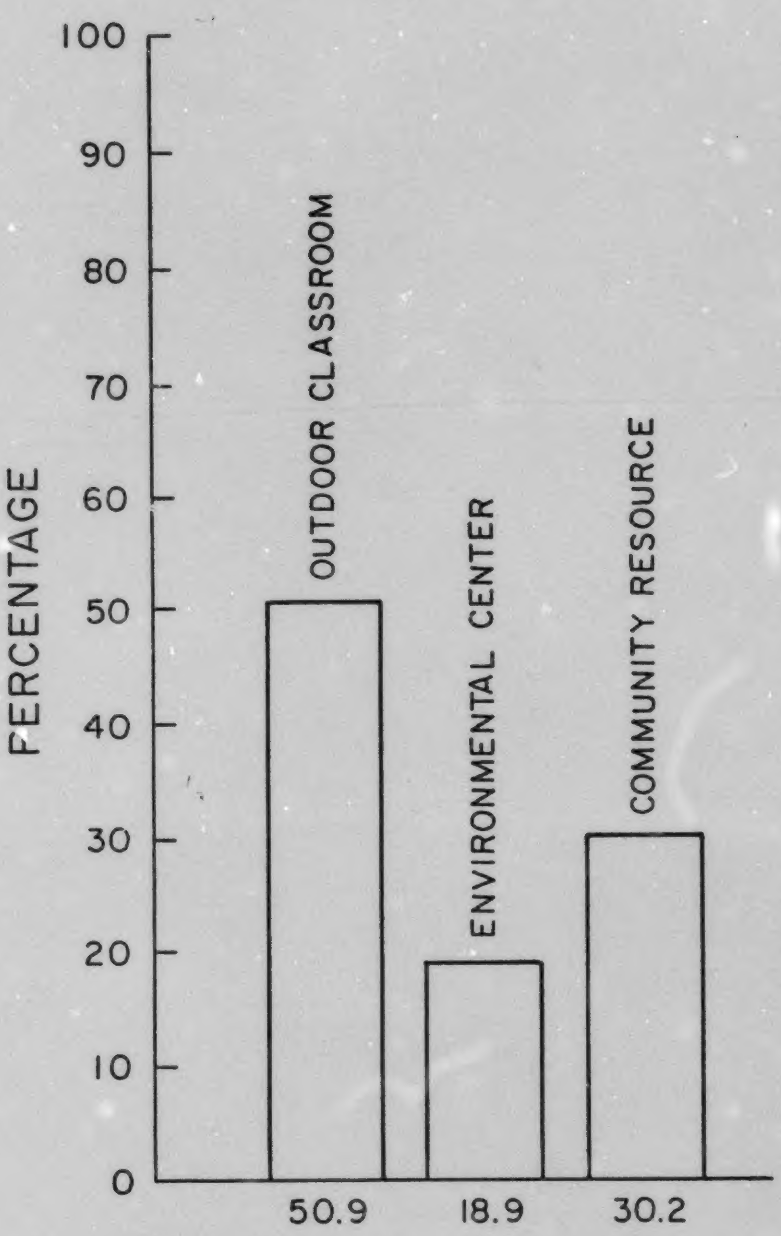

Figure 2: ENVIRONMENTAL EDUCATION FACILITIES

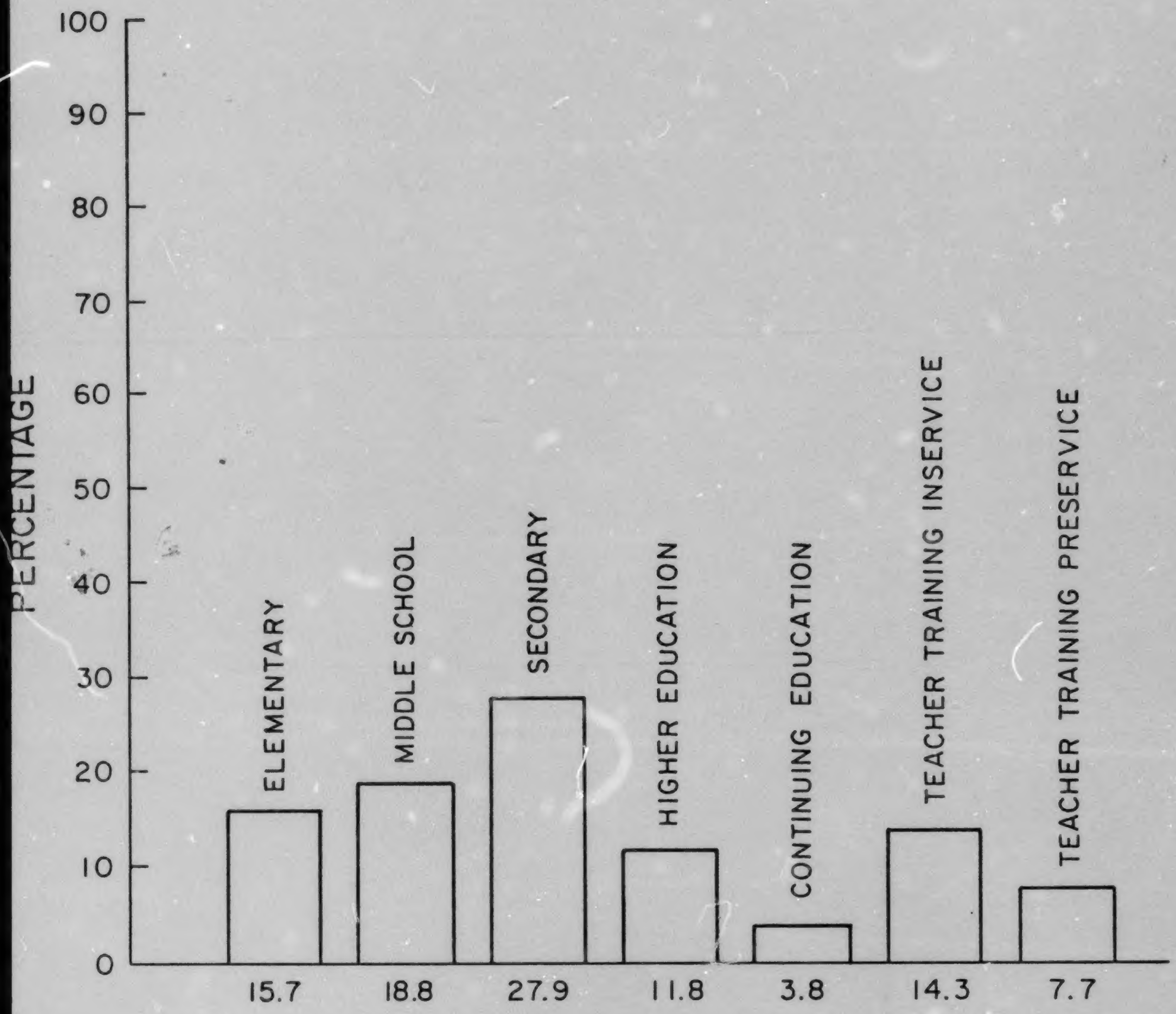

Figure 3: EDUCATION LEVEL

Studies designed to investigate some aspect of EE teacher in-service training (14.3%) and education at the college level (11.8%) also seemed to generate significant interest.

Learning Domain

This category includes the three domains so familiar to educators. It was included here to determine which domain generated the most interest on the part of researchers (Figure 4).

The greatest numbers of studies dealt, surprisingly, with the affective domain (57.7%), followed by the cognitive domain (41.4%). "Surprisingly" here refers to the fact that in most research in other areas researchers tended to focus more heavily on the cognitive domain rather than the affective domain as occurred here. Also, somewhat perplexing, is the small number of studies that dealt with the psychomotor domain. Surely, most of the earlier EE programs were very much "outdoor" and "physical" oriented. Yet, only two research studies focusing on the psychomotor domain were identified from over a decade of EE research efforts. It should be stressed that while the literature may include additional papers about EE and the psychomotor domain, the NCEER found only two that were considered research according to its guiding criteria.

Nature of the Study

This area was included by the NCEER in an effort to try to determine what aspects of EE researchers were most interested in or concerned about (Figure 5). Again, one area of interest stands out clearly from the others: program evaluation (37.5%). Program development (17.7%) and instrument development (16.7%) were relatively close in the degree of emphasis received. One might conjecture that instrument development and all that it entails (e.g. validation, norming, etc.) is a logical concurrent and/or follow-up activity to program development and thus a reason for both receiving near equal attention, it is impossible to tell with any degree of confidence if such is the case here. Model building (11.5%) and hypothesis generation (9.3%) studies - somewhat sophisticated endeavors - seemed to have gained an appreciable amount of attention from the researchers. Only 18 studies (6.7%) dealt with program implementation concerns.

Research Methods

In this most revealing figure, there is no question as to the dominant type of research conducted in EE during 1971-1982 (Figure 6). More than 70% of the research was classified as "descriptive" by the NCEER. The fact that most of the studies conducted during that time period were "descriptive" in nature is most reasonable and logical, particularly when one considers that EE was really an emerging area of inquiry. Now that the ground work has been done, EE researchers need to begin to emphasize a more directed type of research employing more vigorous research designs and methods.

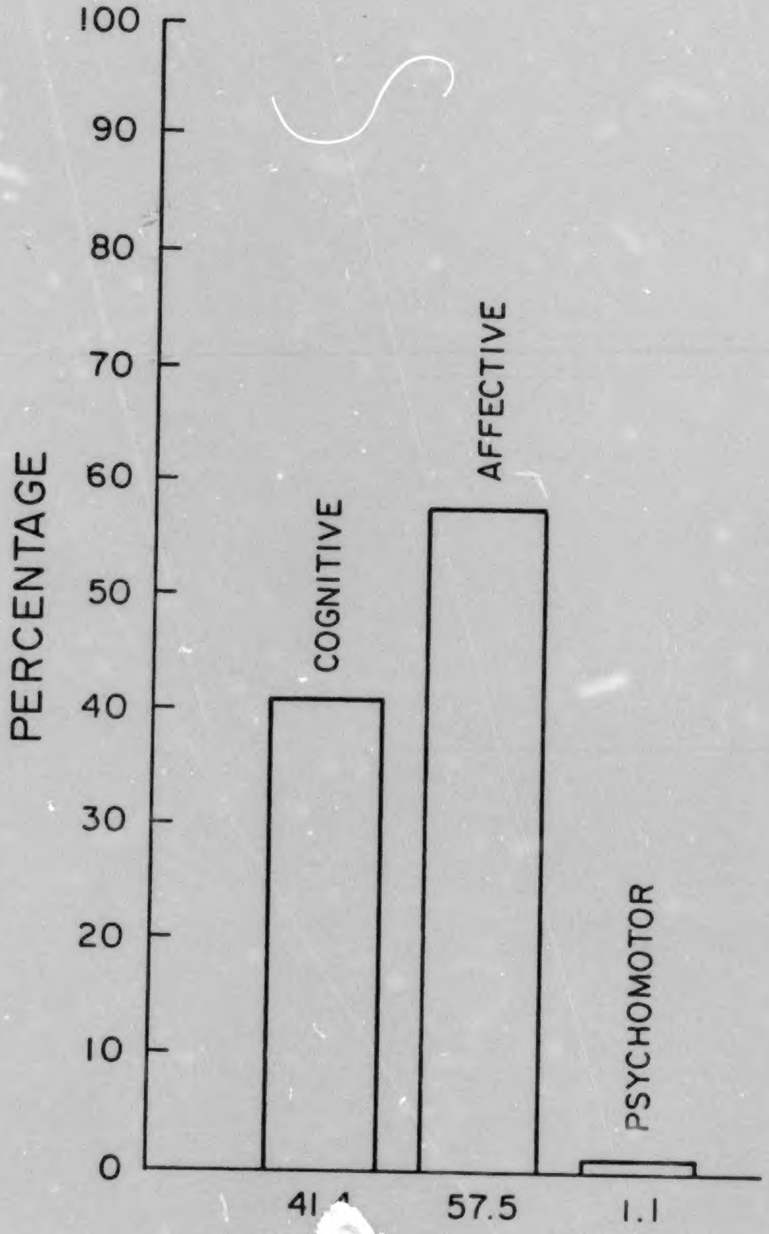

Figure [illegible] LEARNING DOMAIN

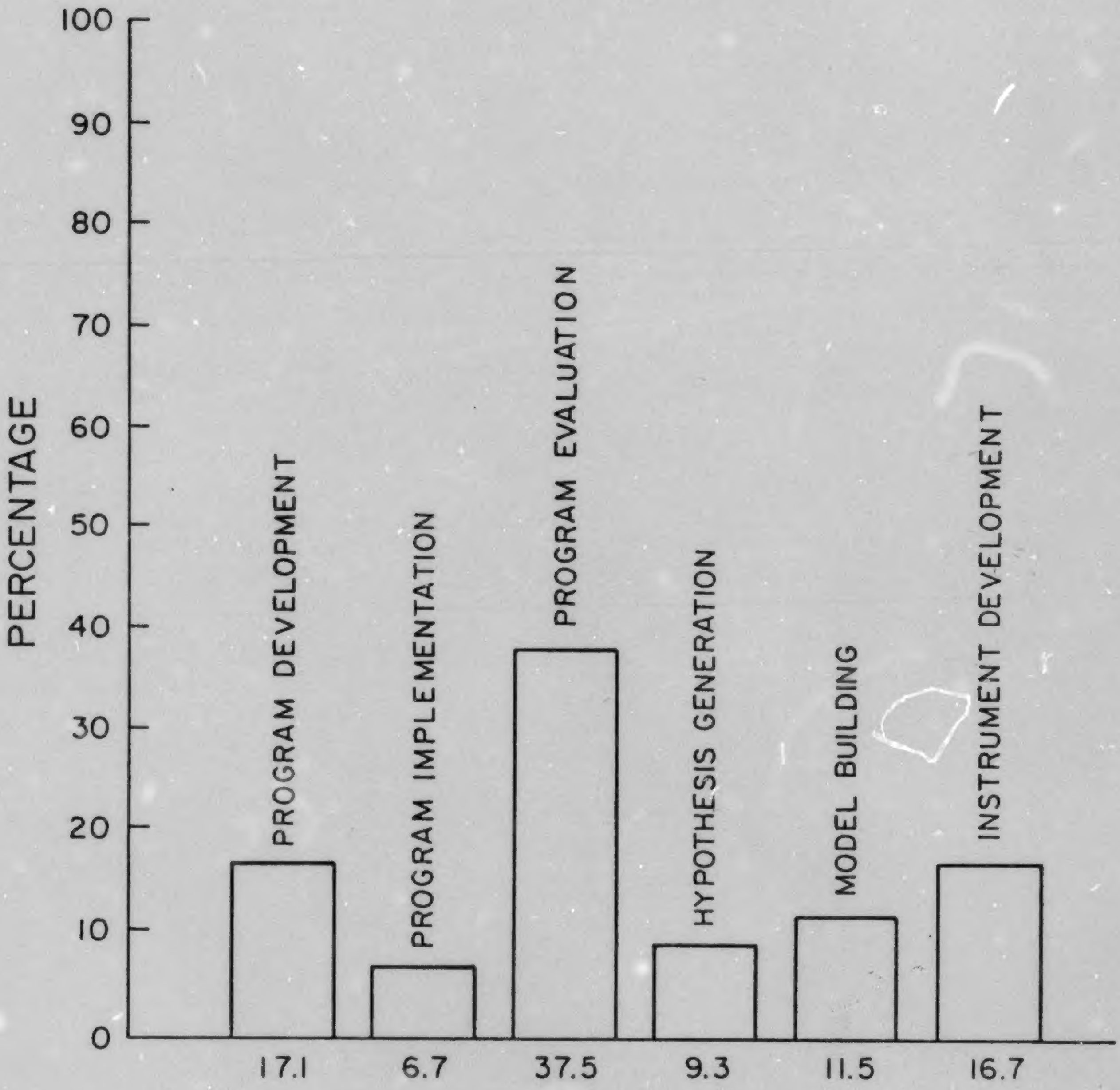

Figure 5: NATURE OF THE STUDY

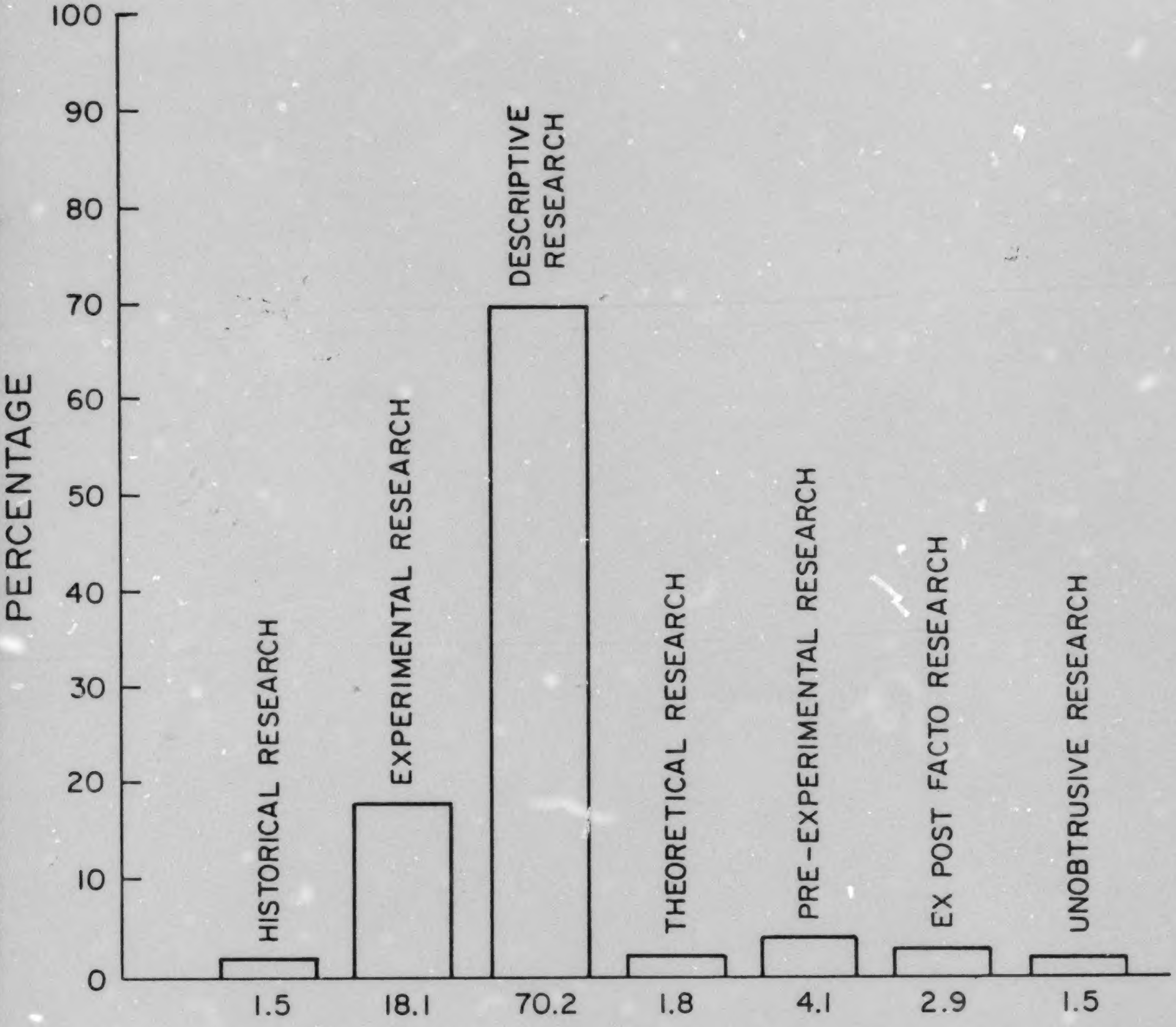

Figure 6: RESEARCH METHODS

Most encouraging is the percentage of studies classified as true "experimental" research. This could be a sign that the field is, in fact, maturing. Whether this is truly the case could be verified only after an extensive analysis in which one would have to compare the dates during which the descriptive studies were conducted with the dates during which the experimental studies were done. One would expect that most of the descriptive types of studies were completed during the earlier years covered by this volume (e.g. 1971-1976) while the majority of the "experimental" studies were probably completed more recently. This issue merits further consideration and should be explored in future NCEER projects.

Environmental Education Methods

About 9% of the studies conducted during 1971-1982 looked at the types of methods employed by EE practitioners to make their students more environmentally literate. If, as some EE leaders believe (certainly not all - including this author) that EE is an outgrowth of Outdoor Education, then Figure 7 provides some evidence to support their position. More than half of the studies dealt with exploring the use and effectiveness of outdoor education methodologies. With the exception of the use of simulations (11.9%) and field trips (11.9%), researchers were largely not interested in exploring any other methods used in EE. In more recent years, however, there was some evidence that indicated that the "case study" approach (7.1%) was generating increased interest among researchers.

EE Curriculum Mode

An analysis of the EE Curriculum mode category was useful because it gave some indication of the relative percentages of EE curricula emphasizing "interdisciplinary" EE, "multi-disciplinary" EE, and whether programs were taught via the formal or non-formal sectors. These data appear in Figure 8.

As one might expect, most curricula are taught by the formal education sector (47.9%) followed by the non-formal sector. It is somewhat surprising - and encouraging, for that matter - to see such a large percentage of the programs and research efforts contributed by the non-formal sector (34.1%). "Interdisciplinary" and "multi-disciplinary" programs seemed to have been given much more "lip service" than real consideration by EE curriculum writers judging by the relatively few studies (21 and 9, respectively) conducted by researchers during the time span covered by this project.

Learner Traits

Eighteen learner traits were included among the 74 descriptors used by NCEER abstractors to code the more than 500 studies included in this volume and in the RIEE (Figure 9). With the exception of EE attitudes, knowledge, and behaviors, all other traits received relatively little attention from researchers between 1971 and 1982.

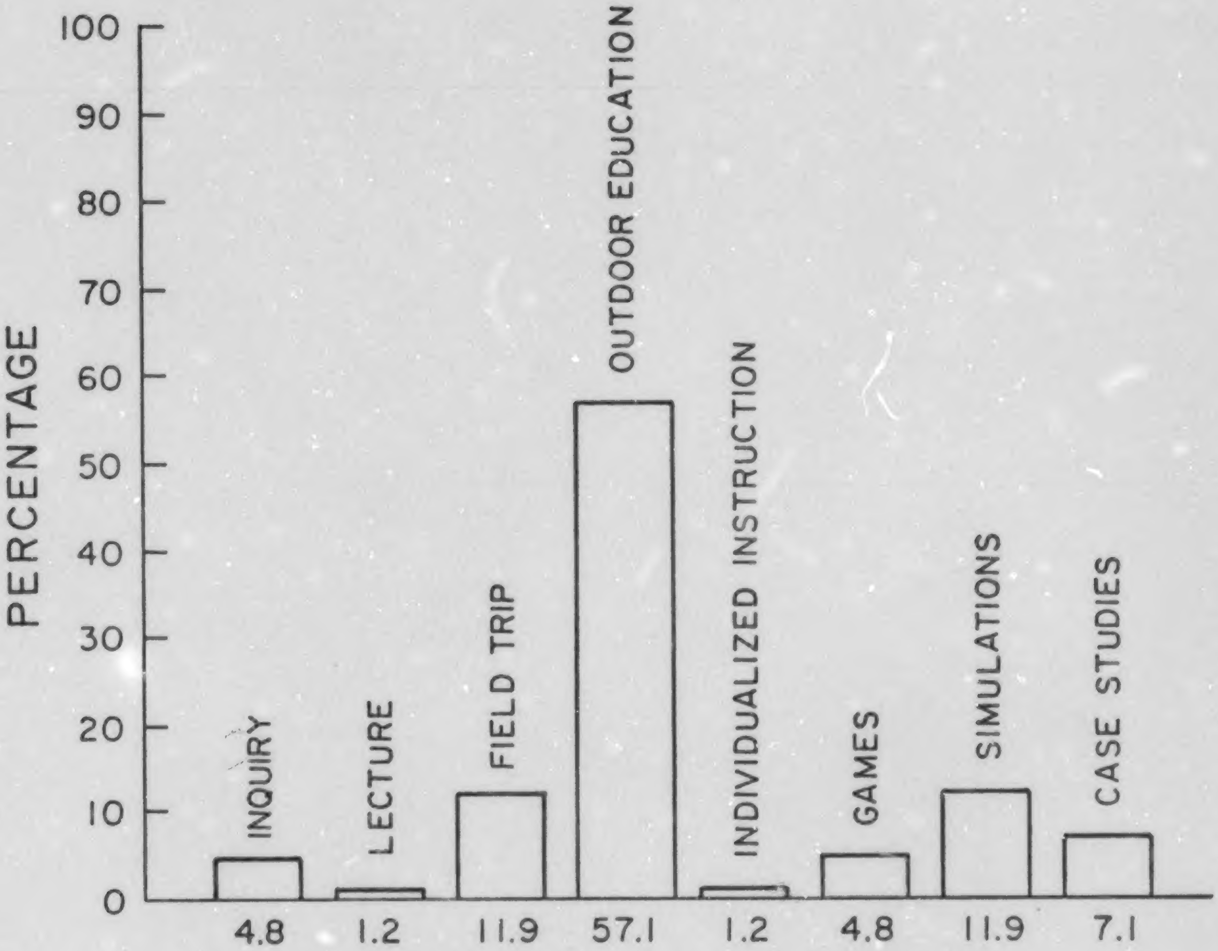

Figure 7: INSTRUCTIONAL METHODOLOGIES

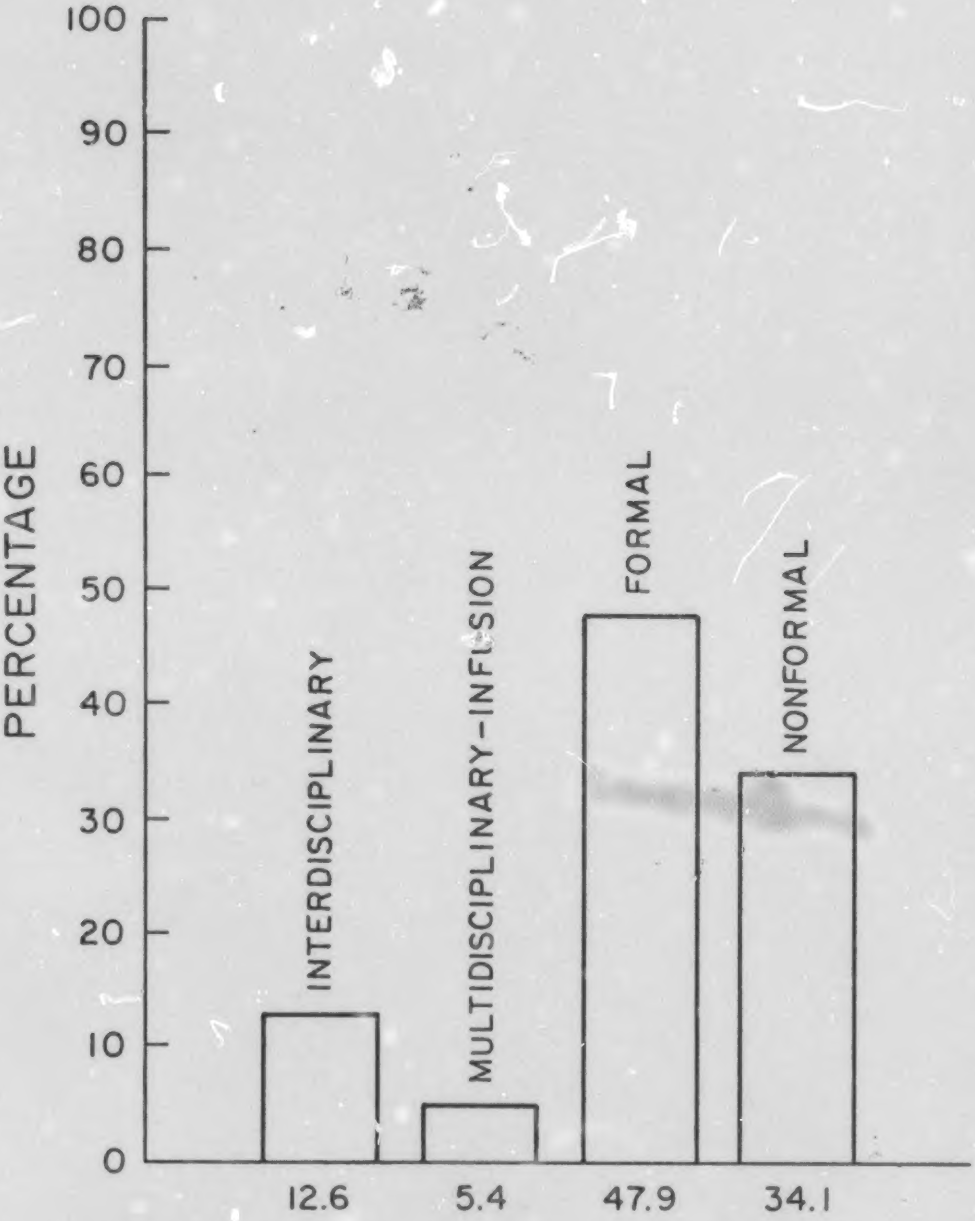

Figure 8: CURRICULUM MODES

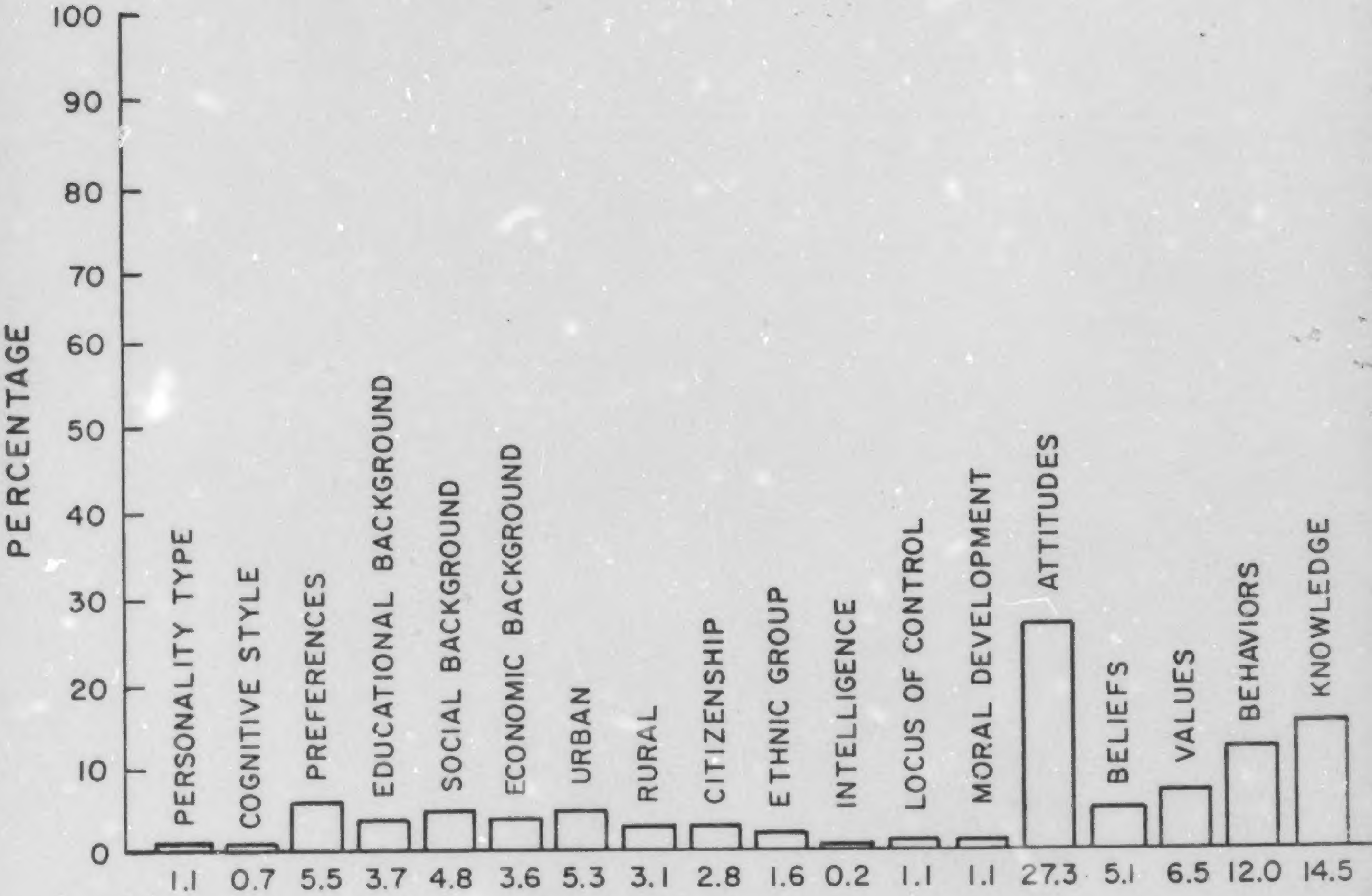

Figure 9 : LEARNER TRAITS

The learner trait in which most researchers seemed to be interested was environmental attitudes (27.3%). Environmental knowledge (14.5%) and environmental behavior (12.0%) were relatively higher than the other 15 traits investigated; it would seem that they should have merited more interest than they, in fact, generated.

Figure 9 provides useful guidance for researchers desiring to further investigate learner traits. Clearly, all of the learner traits shown in Figure 9 are fruitful areas for researchers to explore. As the body of research regarding EE and how it relates to the 18 learner traits grows, curricula can be developed to better match the varying needs of all sectors of society.

EE Content Area

As part of what more traditional subject areas is EE most often taught? Figure 10 was designed to address this question.

EE programs were mainly issue based - that is, special courses focusing on the major international, national, state, and local issues of importance (16.1%). Not surprising, an equal percentage of EE took place as part of Outdoor Education programs (16.1%) and, to a lesser - but significant degree - as part of Resource Management courses (13.7%), Science Education courses (12.7%), Conservation (11.0%), and Energy Education (11.7%). Some might consider Energy Education to be, in fact, EE. The NCEER, however, decided to handle Energy Education as a separate discipline.

Despite the fact that most Environmental Educators maintain that EE is interdisciplinary, it is interesting to note that only 4.7% (14 studies) of the studies dealt with EE and how and/or to what extent it was included in Social Studies programs. EE is, in general, included in most disciplines but, as one would expect, to a relatively small degree.

Percentage of Studies - By Category

Figure 11 shows the percentage of studies that dealt with each of the nine (of ten) categories that comprised the 74 descriptors. Only nine of the ten categories were used because the sixth category "Research Methods" included all studies. That is, each of the studies had to fit under one of the Research Methods descriptors included in Figure 6.

That all of the studies dealt with one or more EE learner traits is readily apparent from Figure 11 (100%). EE Education Level (67%), Nature of the Study (63%), and EE Content Area (70%) seemed to receive about the same amount of attention from researchers. By the same token, EE Goal Levels (42%), Learning Domains (41%), and EE Curriculum Mode all seemed to generate about the same research activity. Lastly, EE Facilities (12%) and EE Methods (20%) seemed to interest researchers least during the time period 1971-1982.

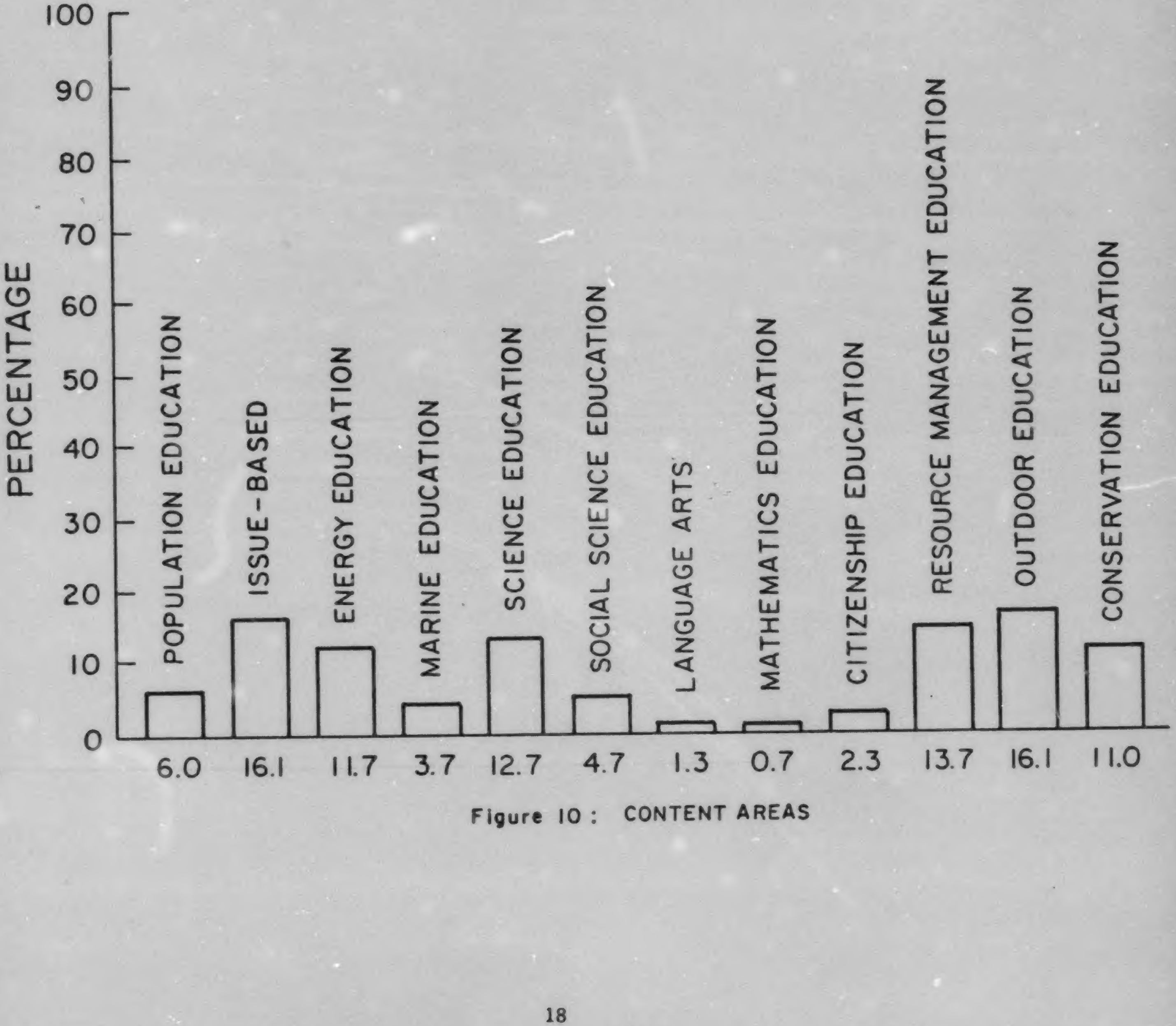

Figure 10: CONTENT AREAS

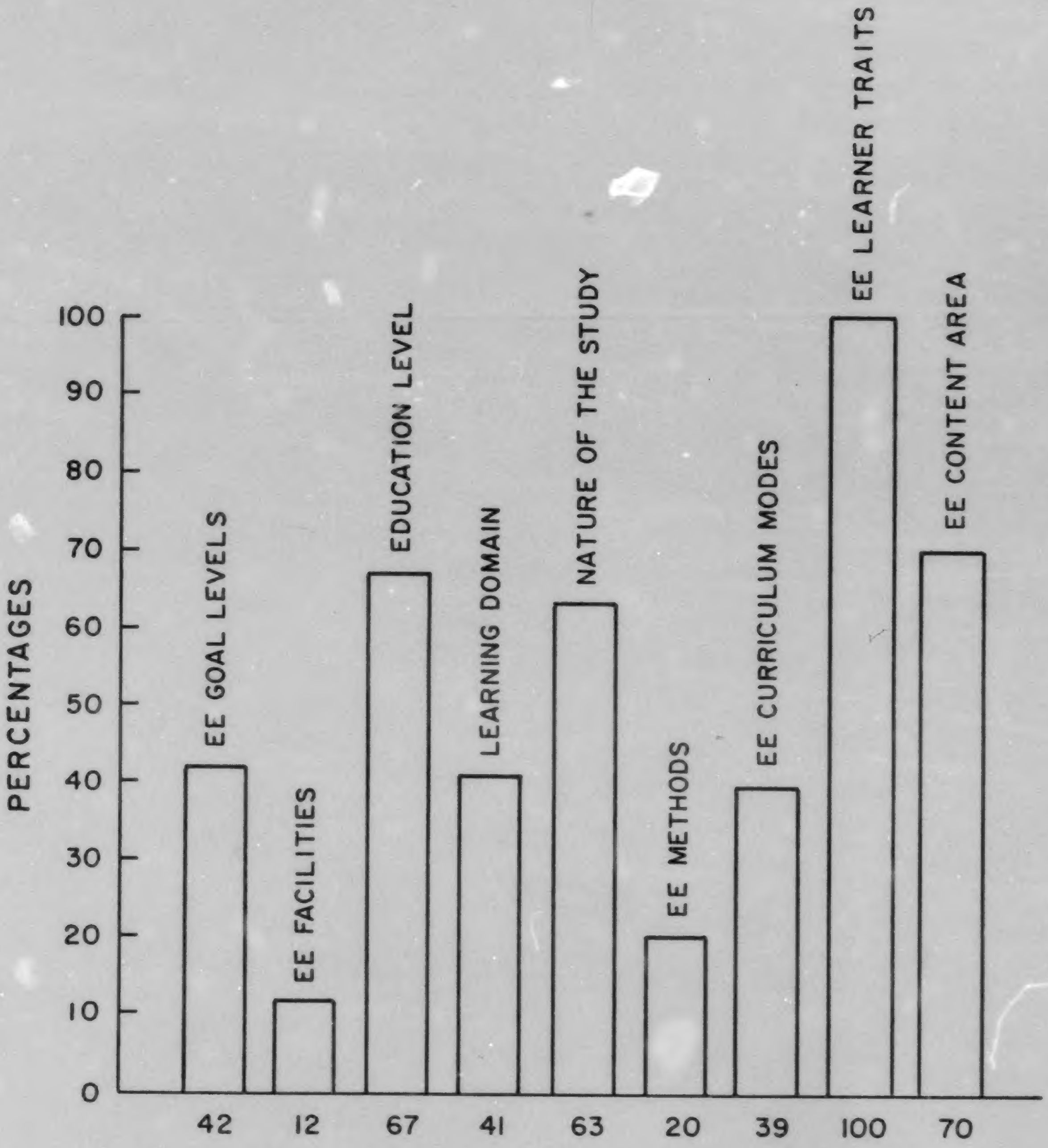

Figure 11: PERCENTAGES OF STUDIES BY CATEGORY

II. Environmental Education Research Related to

ECOLOGICAL FOUNDATIONS

Thomas J. Marcinkowski[1]

For the purpose of this synthesis, the concept of ecological knowledge was extended beyond its generally recognized definition: "knowledge of ecological concepts and principles." As a result, this chapter deals with knowledge and application of general as well as issue-based facts, concepts and principles.

Included in this synthesis are 39 research studies dealing with attributes of and educational resources for ecological literacy. Approximately one quarter of the reviewed studies focus upon the development or descriptive analysis of educational resources commonly utilized in the transmission of ecological knowledge: curriculum goals and concepts, outdoor labs, programs, courses and printed literature. Nearly half of the reviewed studies focus upon the methodological testing of instructional materials and methods employed in the development of ecological literacy in formal and non-formal settings. Also, nearly one quarter of the studies involve descriptive analyses of the status of ecological knowledge and of correlates of ecological knowledge (e.g. ecologically related attitudes) within discrete sample populations. The few remaining studies are oriented towards the development of research and evaluation instruments which may be used in assessing attributes of ecological literacy.

Status Reports Related to Ecological Literacy

Seventeen studies abstracted in RIEE dealt specifically with status reports related to ecological literacy. Eleven of these studies focused on the status of educational resources related to the acquisition of ecological knowledge, and six studies involved assessments of the status of major attributes of ecological knowledge for discrete sample populations. As a whole, this collection of studies is diverse in terms of the types of variables investigated in each study.

Hungerford, Peyton and Wilke (131) developed a set of Goals for Curriculum Development in Environmental Education as a result of collaborative efforts and two validity checks. This set of goals posited "Ecological Foundations" as the first of four goal levels. The description of this goal level included a list of areas of ecological concepts and principles intended to serve as a minimum competency level for ecological knowledge in EE.

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In a related concept oriented vein, Foster (293) sought to develop an ordered structure of ecological statements (i.e. facts, concepts) and principles about the Chesapeake Bay Estuarine System as the basis for curriculum development. While the scope of the resulting ordered structure was ecologically and geographically limited, the rigorous methods relied upon in generating that structure appear to be more widely useful and of greater importance. These methods included the development of a guiding theory of science education, the selection of validation procedures and guidelines for developing a consistent, ordered structure of ecological statements and principles, and the careful implementation of these procedures and guidelines. When considered together, the studies of Hungerford et al. and Foster can present macro and micro views of the bases for curriculum development related to ecological literacy.

Nine studies focused upon the status of curricular and instructional resources often relied upon in the development of ecological literacy. Of these studies, three focus upon curriculum assessments, four on printed matter assessments and two on outdoor site development. Studies by Magnum and Mertens (174), Childress (59, 278) and Blum (437) focused upon the assessment of curriculum programs, projects and courses. In an early (1971) attempt to determine the content orientation of higher education general ecology courses, Magnum and Mertens (174) surveyed members of the Ecological Society of America. They concluded that while course content varied widely, it tended to emphasize classical topics such as succession, population ecology and community ecology. In addition, they noted that many respondents felt that classical ecology texts did not sufficiently emphasize current human ecological topics such as overpopulation and pollution. It was also recommended that more pre-service biology teachers should be required to take a general ecology course.

The two additional curriculum assessment studies targeted elementary and secondary programs/projects. In a 1976 national assessment of public school EE programs and projects, Childress (59, 278) found that the Ecological justification was rated highest for EE programs/projects among respondents. He also found that the objective focusing on classical and current ecological knowledge was rated highest among the "primary objectives" of EE programs/projects. In another study, Blum (437) conducted a national assessment of Environmental Science Education projects in existence prior to 1974 and of those developed between 1974 and 1977. He found a positive shift in the frequency of including ecological topics in project curricula: from 14 of 39 pre-1974 projects to 16 of 17 projects completed from 1974-1977. It appears that a majority of the developers of EE related K-12 programs through the mid 1970's recognized and included ecological objectives and topics in these programs.

Studies by Pettus (330), Stuart (496), Wijesinghe (342) and McKenna (482) involved content analyses of textbooks or related printed materials which included treatments of ecological concepts. Pettus (330) conducted a content and trend analysis of the treatment of ecology, air pollution and water pollution in a selection of recommended science books for elementary grades published in the U. S. between 1960 and 1975. Despite fluctuations in the pattern of disciplinary treatment over several time periods, she concluded that there was a definite trend toward the writing and publication of interdisciplinary children's books on ecology and pollution during the period studied.

Stuart (496) and Wijesinghe (342) both conducted content analyses of secondary level textbooks which focused, in part, upon the treatment of ecological concepts. Stuart (496) analyzed 15 life science textbooks widely used in grades 7-12. He found that among the six categories used to classify life science, the greatest number of concepts was included in grades 7-9 texts and the second highest mean number of concepts was included in grades 10-12 texts. In a narrower context, Wijesinghe (342) analyzed the treatment of population concepts in social studies and biology texts used in grades 7-12 instruction in Florida. She found that texts almost uniformly gave "low" to "no coverage" on certain population concept areas, including ecological systems and several aspects of human population ecology. In addition, Wijesinghe surveyed teachers to determine their use of the population sections of their texts and found that a majority did not utilize all of these sections. Frequently identified reasons for omitting the population sections included lack of time, absence of population content in texts, better sources of material, and the outdated nature of material in the texts. Study recommendations focused on identified curricular and teacher training needs. These findings and recommendations appear to be consistent with those previously cited by Magnum and Mertens (174).

The fourth analysis of printed materials was reported by McKenna (482). A team of four science/environmental educators categorized and reviewed a selection of books concerned with energy topics published after 1970. The books were categorized into one of four educational levels (i.e. K-7, 7-12, 12-College, College/Adult) and into appropriate topical subdivisions, one of which emphasized ecological concepts. For each educational level, the reviewers identified several "outstanding" and "good" books which included ecologically related energy topics. As a whole it is important to recognize that researchers looked for and found the treatment of classical and issue-related human ecological concepts in a variety of educational materials used at all educational levels. Aside from this, few if any substantial conclusions can be drawn from these four studies.

Studies by Donaldson and Schmidt (70) and Werling (341) attempted to generate models of outdoor site characteristics and for outdoor site stewardship respectively. Both studies hold implications relevant to the use of outdoor sites in the development of ecological literacy. From the literature and from conferences with professional colleagues, Donaldson and Schmidt (78) identified 38 potentially desirable site characteristics. A Likert type rating of each characteristic by respondents resulted in the acceptance of 29 characteristics as "desirable," though none were accepted as "essential." Of these 29, approximately half specified ecosystem or other ecologically related site characteristics. However, the researchers concluded that there is probably no such thing as an ideal outdoor site for "eco-educational" purposes. Taking a different perspective on the development of ideal outdoor sites, Werling (341) developed a model focusing on stewardship characteristics rather than physical characteristics associated with outdoor sites. The purposes of his stewardship model were to improve the ecological character and instructional use of outdoor labs and, in a broader context, to develop reinforcing relationships between formal and non-formal educational efforts. The researcher utilized an experimental design to evaluate the effects of that model on fourth/fifth grade classes using existing school sites or neighborhood outdoor labs. He concluded that the stewardship model was practical, effective and a useful alternative to annual field trips. Collectively, these two studies appear to present a useful, balanced approach to the development of outdoor sites for use in the development of ecological literacy.

There is a second group of studies which involved assessment of the status of major attributes of ecological knowledge for discrete sample populations. Two of these studies focused on concepts of the field of ecology, while five focused on knowledge of specific ecological concepts. Owley (325) and Zosel (350) used interview and testing formats respectively to determine the status of the students concept(s) of ecology. Based upon pilot study findings, Owley (325) developed a semi-structured interview around seven areas of classical and human ecological concepts to be used in assessing the development of the concept of ecology in children. The results of an analysis of variance on mean ratings for each student for each area indicated stage of cognitive development as a significant main effect for all concept areas, with place of residence and stage by gender interactions as significant effects for at least four concept areas. The results of factor analyses led the researcher to conclude that at this level, ecology was perceived to be a relatively unitary concept.

In a related study, Zosel (350) utilized a panel of experts to develop content-valid multiple choice tests to be used in assessing concepts of ecology held by fifth/sixth grade samples. The internal reliability of her 50 item list was .86. Item responses were factor-analyzed, and resulted in the identification of eighteen factors associated with the concept of ecology. This finding appears to be at odds with the conclusions drawn from Owley's factor analysis. This difference might be possibly due to differences in the testing methods used by the two investigators.

Moore (185) relied upon theoretical ecologists to generate ten ecological concepts and then asked applied ecologists to identify issues illustrating those concepts in the development of a 22-item list. She found that items dealing with concepts related to cycles and to the balance of energy and nutrients were easiest for both high school students and members of the League of Women Voters to comprehend while items dealing with concepts related to evolution, environmental adaptation and population were the most difficult to comprehend. Further, subjects more often responded correctly on test items when the correct response was based on a biological principle than when it was based upon a sociological one. This finding, with respect to population concepts, appears to be consistent with previously noted findings of Wijesinghe (342). When studies by Moore, Owley and Zasel are looked at collectively, they present several valid methods for assessing various conceptual aspects of ecological knowledge, although no conclusions can be drawn from their work due to the relatively small number of studies and to differences in both methodology and samples employed.

The remaining four studies were similar to Moore's in that they also assessed knowledge of ecological concepts among high school aged samples. However, for each study the sample size, the scope of the research (e.g. wider knowledge parameters, accompanying attitudinal assessments) and the research methods differed from Moore's. In developing an Environmental Science Test, Fleetwood and Hounshell (97) generated and selected items from a test item pool of 232 cognitive statements covering four dimensions of EE. The Ecology dimension subscale was the largest (37 items; 37% of test items) and included a nearly even distribution of knowledge, comprehension, application and analysis questions. After administering the instrument to a multischool sample of high school biology students, the researchers found the test score distribution to be slightly skewed, indicating that the test was somewhat difficult for the sample. On the ecology subscale the mean score was 12.09 of a possible 37. This is consistent with Moore's (185) findings with respect to high school biology students' knowledge of ecological concepts.

Additional studies by Fortner (292), Fortner and Teates (100) and Ramsey and Rickson (198) sought to determine the status of ecological knowledge as part of broader knowledge and attitude assessment for large high school samples. Using a multiple choice format, Fortner surveyed a stratified sample of tenth graders residing in Virginia on marine knowledge and attitudes. Her results indicated a mean score on the knowledge scale to be 12.5 of a possible 25, with coastal students, particularly males, scoring significantly higher on the knowledge scale than did inland students. Significantly, both groups identified various types of media to be greater influences than formal courses of study in the acquisition of this knowledge. In a related area, Ramsey and Rickson (198) surveyed the knowledge and attitudes associated with five sets of pollution-related issues using an agree/disagree item response format. The subjects in this study consisted of a stratified sample of twelfth graders residing in Minnesota. Of interest here is the assessment of the students' knowledge of ecological concepts as it relates to the extent and causes of pollution. They found a skewed pattern of responses on the knowledge of ecological concepts scale. This scoring pattern appears consistent with the previously discussed findings of Moore (185), Fleetwood and Hounshell (97), Fortner (292), and Ramsey and Rickson (198).

Summary:

Based upon the studies reviewed in this section, it appears that:

1. There is a variety of educational resources for developing attributes of ecological literacy indicated in the literature.

2. There are recognized theoretical and methodological bases to guide the development of curriculum related to ecological literacy.

3. The findings of major curriculum and textbook assessments indicate that EE programs appear to be committed to furthering the development of ecological literacy.

4. There are guidelines for developing both physical and stewardship aspects of outdoor sites for the purpose of furthering the development of ecological literacy.

5. Concepts of ecology appear to be based upon a collection of factors:
    a) cognitive variables (e.g. stage of cognitive development)
    b) experimental variables (e.g. outdoor activity, media exposure) and
    c) demographic variables (e.g. place of residence).

6. Knowledge scores of ecological concepts as measured by several types of instruments appears to be skewed, particularly for biology students.

Predictors and Correlates of Ecological Literacy

Twenty-three studies identified in RIEE dealt with predictors and correlates of ecological knowledge. Although this group of studies is diverse in terms of the types of variables investigated, nearly half of the studies included an assessment of attitudinal correlates of ecolgoical knowledge. For the purpose of organization, these variables have been organized into five general categories: experimental, cognitive, affective, behavioral, and demographic variables.

Experimental Variables

Two experiential variables related to ecological knowledge assessed in the studies reviewed were exposure to sources of information and involvement in outdoor activities. In addition to assessing marine knowledge and attitudes of tenth graders in Virginia, Fortner (292), and Fortner and Teates (100), assessed their related marine experiences. Students were asked to rank marine experience categories according to their relative importance in providing information about the ocean. It was found that watching Jacques Cousteau specials on television, reading National Geographic, and being able to swim each accounted for at least 10 percent of the variation in knowledge scores. Both coastal and inland students had identified T.V. specials and movies with marine themes as the experiences which most influenced their marine awareness. In general, these findings are supported by research on environmental sensitivity-related variables (230, 231).

Ten studies reported on the involvement of formal and non-formal groups in outdoor activities, although only six attempted to assess the relationship of these experiences to ecological knowledge. Across these studies, however, no clear pattern appears to emerge. Gross (295) found that following outdoor activities focusing upon the acquisition of ecological concepts, sixth graders more often saw the outdoors as a place to study than did fifth graders. Werling (341) found that fourth/fifth graders learned concepts equally well in and out-of-doors, although students tended to exhibit greater overall environmental knowledge gains as a result of the outdoor activity. Wade, Falk and Balling (481) compared the effects of familiar and novel outdoor settings on the acquisition of ecological concepts. These researchers concluded that concept acquisition was impaired in novel settings. Andrews (266) utilized scales to measure sixth graders' knowledge of ecological concepts and an unobtrusive photographic measure to determine student involvement in outdoor activity. The results of a Pearson correlation analysis and one way ANOVA indicated no significant relationship between the two variables. Burrus-Bammel, Kidd and Bammel (47) developed self-reporting instruments to measure these variables and conducted tests to determine correlations between them. Finally, Picker (332) also assessed the relationship between knowledge of ecological concepts and involvement in outdoor activities and found significant gains in each as a function of outdoor winter activity. He did not, however, attempt to determine correlations between the variables. Since each study focused on different attributes of the knowledge and involvement variables, and since each utilized different assessment methods, it is not possible to draw definitive conclusions with respect to the relationship between ecological knowledge and involvement in outdoor activities.

Cognitive Variables

Nine studies focused on cognitive and knowledge-related variables which appear to be predictors of or correlates of levels of ecological knowledge. Two cognitive variables were assessed for their formative influences upon knowledge: stage of cognitive development, and cognitive style. In studying childrens' concepts of ecology, Owley (325) showed stage of cognitive development to be a significant main effect in the development of the concept of ecology. Hauser (298) assessed and mapped cognitive profiles of college level biology students involved in audio-tutorial (A-T) and self-instruction (S-I) strategies of learning EE concepts. He found that those deriving maximum cognitive knowledge from an A-T strategy were those who:

1. established realistic goals,

2. communicated with others in a minor way which influenced their goals, and

3. preferred to use a reasoning process which included definite rules and the finding of similarities and differences.

He concluded that these findings added support to Hill's cognitive style theory. In a related area, Gross (295) designed a sensory and conceptual approach to the study of a natural woodland community. Among the participants, he found a significantly greater sensory orientation to woodlands immediately following the treatment. One year after the treatment the previous gains in sensory orientation were no longer significant.

In addition to these formative-type cognitive variables, the literature contained four additional studies which focused largely upon several application type cognitive variables. Using a four group post test only control group design, Howie (128) compared the effects of indoor vs. outdoor instruction on several dependent variables. In developing an instrument to assess the effects of each instructional treatment (i.e. control, classroom only, outdoor only, classroom-outdoor combined), he sought to balance concept with application oriented questions. While the subjects receiving classroom based advanced organizers in conjunction with outdoor instruction exhibited the greatest ability to conceptualize, the researcher concluded that there was litle difference among groups concerning the development of application skills.

Fennessey, Livingston, Edwards, Kidder and Nafziger (96) also used a post test only control group design to measure the instructional effects of simulation exercises and games. Although not explicitly tested for, the researchers expressed interest in the ability of the subjects to apply ecological facts to simulation-based pollution problems.

In two related instrument development studies, researchers sought to emphasize the relationship between cognitive-related application skills and issue-related application topics. As previously noted, Fleetwood and Hounshell (97) sought to balance knowledge, comprehension, application and analysis questions within the 37 item ecological scale of their Environmental Science Test. They sought to achieve a similar balance in these types of questions across the fifty items associated with the test's three environmental issue-related scales. With the help of theoretical and applied ecologists, Moore (185) developed a 22 item multiple choice test to assess comprehension of 10 basic ecological concepts. In this case, the comprehension items were based on contemporary issues that illustrated each concept. Findings for both studies were discussed previously.

Two surveys partially focused on the relationship of ecological knowledge to knowledge of environmental issues. Fortner (292) and Fortner and Teates (100) reported that student performance on ocean-related knowledge scales was relatively consistent across ecologically related items (i.e. physical, chemical, biological) and environmental issue-related items (i.e. a threatened resource, a cultural influence, a political interface). After assessing knowledge of ecological concepts and of issue-related trade-off costs, Ramsey and Rickson (198) analyzed the data for relationships between these two types of knowledge. They found a statistically significant correlation of .19 ($p = .0001$) between the two scales. Due to the range of cognitive and knowledge related variables assessed within these nine studies, it is clear that additional research is needed in these areas.

Affective and Attitudinal Variables

Several affective and attitudinal variables were also assessed for their relationship to level of ecological knowledge. Four studies focused upon these relationships for teacher groups, while fourteen studies did so for other, predominantly student groups. However, of these fourteen studies, only four appeared to report statistical findings on such relationships.

Studies by Jaus (138) and Andrews (267) focused upon knowledge and attitudinal gains of teachers as a function of teacher training courses. In the study by Jaus (138), 51 elementary and middle school teachers were assigned to one of two in-service science methods classes. One group was provided with predominantly ecology-based EE instruction. Following instruction, attitudes toward teaching EE were assessed. Those receiving EE instruction showed significantly greater positive attitudes toward teaching EE. In Andrews' experimental study (267), pre-service teachers were provided with a values-oriented EE unit as the instructional treatment. An analysis of covariance on data from the cognitive test showed significantly greater ($p < .001$) knowledge of ecological facts and principles by the experimental group. In addition, the experimental group showed significant gains ($p < .05$) in attitudes towards 9 of the 16 concepts as a result of instruction. Andrews also found that these teachers were able to foster a positive attitude toward the environment in their pupils.

Studies by Marshdoyle, Bowman and Mullins (480), and Picker (332) included assessments of teacher attitudes following participation in student-focused instructional programs. As in Andrews' study, Picker (332) reported significant pre to post-test cognitive and attitudinal gains for teachers as well as students from the experimental group ($p < .001$). Marshdoyle, Bowman and Mullins (480) surveyed a random selection of Ohio teachers who had used field trips to zoos and two student groups in assessing the value of zoo field trips as a mechanism for teaching EE. The researchers reported significant ($p < .05$) pre to post gains on the ecology oriented test for the student groups following such a trip. They also reported teachers' positive attitudes toward the educational value and recreational value of such trips. All four studies suggest that teachers can and do promote the development of positive attitudes toward important facets of ecologically related EE instruction as a result of training and/or active participation in related educational programs.

Of the fourteen studies which focused upon affective and attitudinal correlates within predominantly student groups, two were surveys, nine involved instructional treatments and three were instrument development studies. Surveys by Moore (185), Fortner (292) and Fortner and Teates (100) included both knowledge and attitudinal scales. In Moore's study (185) neither observations nor statistical analyses performed on League of Women Voters data revealed any correlation between attitudes towards issues and ecological comprehension. However, among tenth grade students, Fortner (292), and Fortner and Teates (100) found a significant ($p <= .01$) correlation between knowledge of the ocean and attitudes toward marine issues ($r = .43$).

The marked difference between these findings is also apparent in two of the instruction-based studies. In an analysis of the effects of instruction on students (ages 16-20) in a forest industry camp, Burrus-Bammel (44) found no significant correlation between the knowledge and attitudinal variables assessed. However, Andrews (266) reported finding a significant positive correlation between sixth graders post-test scores on knowledge of ecological principles and attitudes toward ecological concepts following a six week series of O.B.I.S. activities. In addition, studies conducted by Fennessey, et al. (96), Howie (128), Kidd, et al. (143), Bottinelli (274), Gross (295), Picker (332) and Thiele (334) sought to assess the effects of various instructional regimes on knowledge and attitudes. While all of these researchers reported gains in both areas, none reported correlation coefficients attained between knowledge and attitude scores. The apparently disparate nature of these findings may be possibly explained as the result of differences in the types of instruments employed, and differences in the age/educational level of respondents.

A study which provides further insight into the relationship of knowledge and affective variables was conducted by Thiele (339). He sought to assess an effective/aesthetic approach to self-instructional activities in ecology for college level non-science majors. Thiele (339) utilized a method for analyzing scientific concepts in order to identify closely-related emotionally appealing aspects. Rather than attempt to assess variable relationships following instruction, he did so prior to instruction, and therefore established a basis for integrating cognitive and affective components in the course of developing self-instructional materials. This interest in assessing cognitive and potentially related affective or attitudinal variables is reflected, albeit less directly, in the instrument development studies reported by Burrus-Bammel, Kidd and Bammel (47), Fleetwood and Hounshell (97) and Moyer (177).

Behavior Variables

The only study which attempted to assess the relationship between ecologically related environmental knowledge and environmentally responsible behavior was conducted by Werling (341). While both the "indoor" and the "outdoors" group scored significantly higher ($p < .03$) on the overall environmental knowledge test, there was no significant relationship between knowledge as measured by that test and scores achieved on a littering and environmental stewardship day response behavior measure. The researcher suggested a need for additonal research and for the refinement of an unobtrusive measurement instrument.

Demographic Variables

Finally, researchers assessed the relationship between several demographic variables and ecological knowledge. Fortner (292) Fortner and Teates (100), and Owley (325) reported finding positive relationships between knowledge and demographic variables. Fortner found that mean scores on a "knowledge of the ocean" scale varied significantly according to race, gender (males greater than females) and place of residence (coastal greater than inland). Similarly, Owley (325) found that place of residence had significant effects on knowledge scores for niche, species interaction (urban greater than rural) and adaption (rural greater than urban) while knowledge scale scores varied according to gender for population (male greater than female). Gross (295), Andrews (266) and Moyer (179), on the other hand, reported finding no significant relationships between knowledge and related attitudes for urban/rural, community size, socio-economic status, nor gender variables. Again, the apparently disparate nature of these findings could possibly be explained as a result of differences in the type of knowledge and attitudinal variables assessed, differences in the types of instruments employed, and differences in the age, educational level and experiential background of the respondents.

Summary:

Based on the studies reviewed in this section, it appears that:

1. There is a variety of experiential, cognitive, affective, behavioral and demographic variables which appear to be related, although inconclusively, to ecological knowledge variables.

2. The findings regarding experiential variables are inconclusive. They do indicate that exposure to sources of information and involvement in outdoor activities may, under certain conditions, relate to acquisition of ecological concepts.

3. The findings regarding cognitive variables are mixed. Further research appears to be needed to corroborate findings regarding cognitive style and cognitive development. Researchers appear interested in the development of cognitive related application skills with respect to both classical and human ecology related application topics. Yet the collective findings indicate that levels of ecological knowledge were either not reported or were insufficient with respect to the level of application capabilities tested.

4. As a result of training and/or active participation in ecologically related EE instruction, teachers appear to develop more positive attitudes towards those facets of instruction which are emphasized in their training activities. There is some evidence to support the contention that teachers can develop positive environmental attitudes among their students as a result of instruction.

5. The findings related to affective/attitudinal variables are mixed and indicate a need for more careful theorizing, instrumentation, research, analyses and reporting.

6. Since only one study sought to analyze the relationship between knowledge and responsible behavior, there is an obvious need for further research in this area.

7. The findings on demographic variables, particularly gender and residence, are mixed. Further research, including attempts to assess the relationship between demographic variables and meaningful ecologically related learning experiences (e.g. outdoors, home, school) are needed.

Approaches to the Development of Ecological Literacy in Formal Settings

The studies presented in this section focus upon the development and use of curricular and instructional strategies designed to foster the development of ecological literacy in formal school settings. Thirteen studies abstracted in RIEE dealt specifically with these topics. For the purpose of discussion, these studies are organized under five headings: teacher training approaches, self-instructional approaches, simulation and gaming approaches, the use of advanced organizers, and comparisons of classroom vs. outdoor approaches.

Teacher Training

Experimental studies by Andrews (267), Bluhm and Hungerford (27) and Jaus (138) were oriented toward the development of ecological literacy as part of an EE-related teacher training program. In a pre-service course for elementary teachers entitled "The Learner and His Environment," Andrews (267) offered a values-oriented EE unit designed to effect changes in teacher attitudes towards environmental concepts. An analysis of variance, based on the results of a 45 item cognitive test, showed a significant difference ($p < .0001$) in ecological knowledge between control and experimental groups. There were also significant differences ($p < .05$) in attitudes toward 9 of 16 concepts included in a semantic differential scale. The researcher concluded that the instructional unit was effective.

Also, as part of a pre-service methods course for elementary science teachers, Hungerford and Bluhm (27) utilized basic EE and ecology units in an instructional program. The researchers relied upon a 17 item multiple choice instrument with a test-retest reliability of .9249, for assessing the effectiveness of the ecology unit. In addition, a phenomenological instrument was used to assess the students' ability to define EE. The researchers reported high levels of improvement in the preservice teachers acquisition of ecological concepts as well as in their ability to better define EE as a result of participating in the course.

Finally, Jaus (138) taught inservice elementary and middle school teachers in a graduate level science teaching methods class for the purpose of improving their knowledge of and attitudes towards ecological concepts and environmental issues (e.g. population, pollution, natural resources). The researcher utilized a 50 item multiple choice test to assess concept acquisition, and a three section, thirty item questionnaire to determine teacher attitudes toward teaching environmental education. The latter questionnaire had a test/retest reliability of .88. While all teachers scored 85% or better on the cognitive test, teachers in the experimental group showed much more positive attitudes toward teaching environmental education.

Collectively, these three studies suggest that environmental education related ecology units can be effective additions to methods courses for developing the ecological knowledge of pre- and in-service teachers. In addition, the research suggests that these basic ecology units can be supplemented by units designed to help improve the teaching of ecological concepts within an EE context. Hungerford and Bluhm's unit (27) focused upon a basic understanding of EE, Jaus' unit (138) focused on attitudes towards teaching EE, and Andrews' unit (267) focused on attitudes toward the ecological concepts to be taught. These studies, although few in number, provide some guidance for pre and in-service teacher training programs designed to foster the development of ecological knowledge and related teaching competences.

Self-instructional Approaches

Thiele (339), Dahn (288) and Hauser (298) conducted studies dealing with self-instructional approaches and the development of ecological knowledge. All three studies were conducted at the college level and involved evaluation of specific self-instructional approaches. Thiele (339) developed an affective/aesthetic program of self-instruction in ecology for non-science majors. In the process of developing the program, he utilized audiovisual materials, affectively oriented instruction, and a method for integrating the cognitive and affective components of the concepts. During the first semester an experimental design was employed and during the second semester a non-controlled formative evaluation was conducted. For both evaluations, a test to evaluate the cognitive effectiveness and a Likert-type rating scale to assess dimensions of student satisfaction were utilized. It was found that the experimental group showed a significantly greater ($p< .05$) sense of satisfaction with instruction than did the control group. He also found within the experimental group that women responded significantly more strongly than men. This is noteworthy insofar as the experimental group showed cognitive gains which were equivalent to control group gains. Finally, as a result of the formative evaluation of the experimental approach, specific methods for further improving the program were identified.

The purpose of Dunn's (288) study was also to develop, test and validate a self-paced instructional unit on ecological concepts, particularly those related to the marine environment. A 54 question, multiple choice test was designed to assess the effectiveness of the unit. It was examined by a panel of eight ecologists, altered as recommended, and offered on a trial basis for use with the unit. The same test was used for both pre and post testing. The researchers reported TESTAT reliabilities above .83 for the test. It was reported that a mean score shift of nearly twenty points between pre and post testing was realized. The program was highly successful ($p< .001$).

House (298) analyzed the effectiveness of audio-tutorial (A-T) and self-instructional (S-I) approaches in helping students learn the concept of ecological succession. Utilizing Hill's cognitive style theory as the framework for analysis, House was able to identify characteristics of students deriving the most and the least benefit from the use of each strategy. He found that those deriving the most benefit from the A-T strategy acquired meaning from seeing things other than written words or graphic symbols, while those who derived the least benefit preferred to acquire meaning from these sources. He also found that those deriving the most benefit from the S-I strategy established realistic goals, communicated with others in ways which influenced their goals, and preferred to use a reasoning process (e.g. rules, finding similarities/differences).

On the whole, these studies suggest several concrete methods for approaching the development of curricula, and instruction and assessment tools. Several of these methods could also be applied to previously discussed teacher training units.

Simulation and Gaming

Studies by Fennessey, Livingston, Edwards, Kidder and Nafziger (96) and Bottinelli (274) assessed the effectiveness of simulation exercises and games in developing ecological knowledge. Fennessey et al. (96) adopted a simulation exercise and adapted a simulation game from a Coca Cola Company simulation kit, Man in His Environment. The researchers trained sixty third, fourth and eighth grade teachers to use the simulation as the basis of a unit to be conducted 45 minutes a day for 10 days. Using a post-test only control group design, the researchers sought to evaluate the effectiveness of the simulation by means of an objective test and a questionnaire. Using multivariate analysis of variance, the researchers found that the differences between fourth grade groups was the only statistically significant effect ($p < .013$). Upon analysis, this difference was found to be a result of superior results on fact items included in the simulation. Bottinelli (274) also adopted three commonly available ecologically related simulation games as instructional treatments while he employed a lecture-discussion format for the control group. Over an academic year, he randomly assigned each of four science and social studies classes to one of four treatment groups, with each instructional treatment covering a three-day period. The researcher utilized a cognitive test and an attitude questionnaire to measure the effects of the treatments. His findings suggest that students who participated in the lecture-discussion group scored significantly better ($p < .10$) on these measures than did those participating in the simulation. He also reported finding no significant cognitive retention differences among treatments ($p < .10$) although one of the simulation groups showed significant affective retention differences. The researcher concluded that simulations do not appear to be as effective in teaching concepts when compared to more traditional methods. However, the researcher suggested that simulations can be used in conjunction with other strategies to foster the development of positive environmental attitudes and provide an enjoyable change of pace for classroom activity. These conclusions appear to be consistent with the findings of Fennessey et al. (96) as well.

Approaches to the Use of Advanced Organizers

Studies by Batty (270), Gross (295) and Howie (128) all focused, at least in part, on the use of classroom-based advanced organizers as part of experimental instructional treatments. Using a quasi-experimental design, Batty (270) sought to investigate the effects of a treatment consisting of advanced organizers for a four-week unit in oceanography. This unit was to be taught to four classes of earth science students in an inner city school. Two teachers each taught one experimental and one control class. There were no significant differences ($p < .05$) detected on either pre-test or post-test scores between the experimental and control groups, nor were there significant differences related ($p < .05$) to learning concepts of oceanography. The researcher concluded that students given advanced organizers did not reflect any greater facility in learning the concepts of oceanography over those who did not receive the advanced organizer, yet both teachers have continued to use sections of the advanced organizer material in their classes.

In studies by Gross (295) and Howie (128), advanced organizers comprised part rather than the whole of the experimental treatment. Further, both researchers utilized this approach prior to outdoor instruction. In both cases the use of advanced organizers was found to be significant. Gross (295) used advanced organizers to introduce concepts that would be taught during a specially designed sensory and conceptually oriented field trip to a woodland wilderness community. Six instruments were administered on a pre-test, post-test (fifth grade) and delayed post-test (sixth grade) basis to assess the effects of the treatment on select knowledge, perception and attitudinal variables. The reported findings include: significantly greater ($p < .05$) cognitive knowledge gains on post-test scores when compared to both pretest and delayed post-test scores, significant gains ($p < .05$) in perception of woodlands as well as significantly more positive ($p < .05$) attitudinal growth toward the preservation of wilderness. However, since the treatment consisted of the combination of advanced organizers and the field trip, the effect of the advanced organizers alone was not tested and, therefore, could not be detected. Howie (128), using a four group post-test only control group design, developed three treatments: (1) classroom instruction which included advanced organizers, (2) a two-day outdoor education program which included hikes, tours and demonstrations at a nearby environmental study center and, (3) a group consisting of both classroom and outdoor instruction. It was found that students in the treatment groups receiving advanced organizers were better able to conceptualize than those who did not receive the advanced organizers. These organizers played a significant role as part of the combined instructional treatment prior to outdoor program. While no solid conclusions can be drawn with regards to the use of advanced organizers, it may be tentatively inferred that their use prior to both indoor and outdoor instruction can serve to enhance readiness regarding concept acquisition.

Comparisons of Classroom and Outdoor Approaches

Howie's (128) findings suggest that a combination of appropriate classroom and outdoor approaches is likely to be more effective in aiding concept acquisition than either all classroom or all outdoor instructional approaches. Werling (341) used a three-group pre and post-test control group design to assess the comparative effects of classroom vs. outdoor instruction in the acquisition of ecological environmental concepts, understandings and facts. The control group received indoor science instruction (SCIS), the indoor experimental group received SCIS instruction with EE lectures and the outdoor experimental group received a modified SCIS and OBIS outdoor approach to site stewardship. All instructional treatments lasted 8 weeks. Students' knowledge of SCIS concepts and of the environment were measured using local school district and State of Illinois tests. It was found that students learned SCIS life science concepts equally well in the classroom and in the outdoors. As a result of study differences (e.g. the arrangement of experimental treatments) Howie and Werling have arrived at different although not necessarily incompatible findings regarding the effectiveness of classroom, outdoor and combined instructional approaches in fostering the acquisition of ecological concepts.

Summary

Based on the studies reviewed in this section, it appears that:

1. Traditional lecture and discussion, self-instructional simulation, advanced organizer and combined indoor-outdoor instructional approaches can be effective in the development of ecological knowledge in formal settings.

2. Ecological units can be effectively added to methods courses as an approach to fostering the acquisition of ecological concepts by pre and in-service teachers. EE and attitudinal units or unit components can also be effectively used to improve teachers' abilities and willingness to teach ecological concepts within an EE context.

3. College level self-instructional approaches to the learning of ecological concepts can be effective when designed with both a cognitive and a balanced cognitive-affective approach in mind. In addition, research in the area of cognitive style suggests that both audio-tutorial and self-instructional strategies are generally geared for learners who exhibit discrete learning attributes and patterns.

4. Simulation games do not appear to be any more effective in teaching concepts than any other methods. They are useful, however, to supplement other methods to foster both concept acquisition and positive environmental attitude formation. Simulations provide a change of pace for classroom activity.

5. The findings related to advanced organizers are mixed. They appear to be somewhat useful prior to further classroom-based instruction. When offered prior to outdoor instruction, they appear to be useful in preparing students for concept formation and acquisition.

6. The findings on the comparative value of classroom vs. outdoor instructional approaches are also inconclusive. Both appear to be useful approaches in fostering the acquisition of ecological concepts. However, a combined rather than a comparative approach appears to be more useful for this purpose.

Approaches for the Development of Ecological Literacy in Formal Groups in Non-Formal Settings

The studies presented in this section are primarily concerned with instructional approaches to foster the development of ecological knowledge within formal school group members in non-formal instructional settings. In previously discussed studies, Howie (128) and Werling (341) provided instruction for school groups in non-formal settings (e.g. on environmental center and outdoor approaches to ecology-based instructional activity). There appear to be four additional studies which emphasize ecology-based instruction for school groups in non-formal settings.

In an attempt to examine the relationships among cognitive, affective and behavioral domains, Andrews (266) organized a six-week-long series of O.B.I.S.-type outdoor activities concerned with ecological principles for a group of 58 sixth graders in Maine. The data revealed no significant relationship between knowledge of ecological concepts and involvement in the outdoors. However, significant relationships were found between knowledge of ecological concepts and positive attitudinal changes toward those concepts as well as between positive attitudes toward ecological concepts and involvement in the outdoors. It would appear that knowledge of ecological concepts and involvement in the outdoors may be indirectly related and meditated by intervening attitudinal factors.

Similarly, Gross (295) designed a combined advanced organizer and special acclimatization type sensory and conceptual approach to the study of natural woodland wilderness community for fifth and sixth grade students in Iowa. As described in the previous sections, he reported significant ($p < .05$) cognitive, attitudinal and perceptual gains for participants on four of the six measurement scales utilized. Unlike Andrews, he did not attempt to assess the relationships across these variables. However, the relationship of gender and SES to the dependent variables was examined with no significant relationships found.

Picker (332) designed, field tested, and evaluated a 10 unit program on winter ecology for tenth grade biology students in Maine. The conceptual framework for the units was derived from *Biological Science: An Ecological Approach*. The instructional methods for delivering this program included both laboratory and field techniques. Experimental teachers were trained in the use of the trial program units. Experimental group members were pre and post-tested on a 25 item ecological knowledge test, while both control and experimental groups were pre and post-tested on a 67 item attitude inventory test and a 24 phrase semantic differential measure of involvement with the winter environment. The researcher reported significant cognitive gains ($p < .0001$) for the entire experimental group and for three experimental teacher subgroups, significant positive attitudinal gains ($p < .001$) for the treatment group and two experimental teacher subgroups, and significant involvement with the winter environment for the treatment group and two experimental teacher subgroups. These findings appear to be similar to those of Andrews (266) although like Gross (295) no attempt was made to assess relationships across these variables.

The final study in this section was conducted by Marshdoyle, Bowman and Mullins (480). They assessed the perceived value and impact of student field trips to a community resource, the zoo. The researchers surveyed perceptions of the educational and recreational value among a random sample of Ohio teachers who had led such a trip and found a very high percentage of "agree" to "strongly agree" responses regarding these values. Using a pre-experimental design, the researchers assessed fourth and fifth and fifth and sixth grade treatment groups using a test of their knowledge one day before and one day after a zoo field trip. The control group received a pre-test and the same wildlife knowledge test following the trip. An analysis of the data indicated that though there were no significant differences ($p > .05$) between groups on post-test scores, while significant pre to post-test differences ($p < .05$) were found in all but one section of the test for the experimental group. The researchers concluded that learning in the area of ecologically related wildlife facts and concepts did occur as a result of the school field trips to the zoo.

Summary

Based on the studies reviewed in this section, it appears that:

1. There are a variety of non-formal settings which formal groups can and do rely upon to assist in developing ecological knowledge. These include woodlands, zoos, environmental centers, and outdoor laboratories.

2. There appears to be a variety of instructional methods employed in non-formal settings to assist formal groups to further develop their ecological knowledge: field trips, tours, demonstrations, field and lab techniques, sensory approaches and other related forms of outdoor activities.

3. There appears to be a variety of available curricular and instructional materials which can be adopted/adapted for use by formal groups in non-formal settings to assist in enhancing ecological knowledge: SCIS, O.B.I.S., Acclimatization and Biological Science - An Ecological Approach.

4. The use of non-formal settings by formal groups may lead to positive gains in conceptual knowledge, particularly when supplemented by advanced organizers. In addition, the use of advanced organizers may lead to significant perceptual and attitudinal gains as well as greater involvement in the outdoors when this type of non-formal setting is utilized. While the use of non-formal settings appears to provide a more holistic approach to the development of ecological literacy, there are few data from which to draw conclusions on the relationships among and integration across knowledge, perceptual, attitudinal and involvement variables.

5. The use of non-formal settings by teacher-led formal groups may lead to similar cognitive, perceptual and attitudinal gains among the teachers. Further, teachers who are experienced in the use of non-formal settings appear to recognize both their educational and recreational values.

Approaches for Development of Ecological Literacy in Non-Formal Settings.

These studies are primarily concerned with the development and use of curricular and instructional strategies which are designed to foster the development of ecological literacy among non-formal groups in non-formal settings. There are only five studies which fall in this category. Three of those are associated with the same Forest Industries Camp Program: Burrus-Bammel (44); Burrus-Bammel, Kidd and Bammel (47); and Kidd, Burrus-Bammel and Bammel (143). Surprisingly, this is a small number of studies given the volume on non-formal settings involved in delivering educational programs in ecology to non-formal groups (e.g. National and State Parks, nature and environmental centers, camp and resident outdoor programs, field schools, zoos and museums). There are many possible reasons for this in view of the fact that many of these types of programs came into existence long before the formal origin of EE in the late 1960's. There has been a lack of research effort in the area of ecological knowledge in these settings during the research period (1971 - 1982). Hence, there is a need for a more extensive research effort here.

The studies by Burrus-Bammel, Bammel and Kidd (44, 47, 143) focus on gains in forest ecological-related knowledge and attitudes among youth (ages 16-20) as a result of participation in a Forest Industries Camp Program during 1975 and 1976. Instructional methods relied upon included a mix of indoor lectures and role playing and outdoor field trips and demonstrations to effect acquisition of forest ecology facts and concepts. An objective knowledge test was used a pre and a post-test to measure treatment group learning and was used as a post-test only for the control group (44, 143). The researchers reported significant knowledge gains ($p< .01$) on pre to post-test scores and on pre to delayed post-test scores for 1975 and 1976 treatment groups. Further analysis of the 1975 data indicated that there were significant ($p< .01$) pre to post-test score gains on 10 of the 15 knowledge scale items. However, the researchers concluded (143) by suggesting that a true experimental design should be used to control for internal validity factors (e.g. history, maturation) which could have significantly affected their reported findings.

The other studies which are in this category were reported by Martin, Falk and Balling (481) and San Julian (335). Martin, et al. tested the effects of field trips into both familiar and novel environments on the learning of terrestrial ecology concepts among 10 to 13 year olds. Comparisons of knowledge scales scores for groups experiencing these two environments indicated impaired conceptual learning in the novel environments. They concluded that this supported the hypothesis that novel environments are inferior settings for learning activities when compared with familiar environments due to added demands placed on learners. San Julian's study (335) involved the development of a correspondence course on ecology and environmental issues and an assessment of its effect on opinions about environmental issues. Effects upon ecological concept acquisition were not reported. Only positive attitudinal and opinion related shifts were reported. Due to the small number and character of these studies, it is not possible to draw any generalizable conclusions.

Summary

Based on the studies reviewed in this section, it appears that:

1. Non-formal groups in non-formal settings exposed to instruction in terrestrial ecology can and do learn ecological facts and concepts.

2. A combination of indoor and outdoor instructional methods can be used effectively to effect the learning of facts and concepts.

3. Familiar environments appear to be superior to novel environments as settings for activities which aim to foster the learning of ecological concepts.

4. There is a great need for more research in this area.

Ecological Literacy Research Methodologies

In reporting the relevant variables and findings in the preceding section, little attempt was made to assess the quality of the research as abstracted. It is the purpose of this section to present a synthesized picture of the quality of the research presented in the previous sections using several qualitative indicators. These indicators include: research design and methodology, reports of instrument validity and reliability, reports of the accepted level(s) for statistical significance and the extent to which the authors used and cited relevant literature from the field.

Table 1 contains data pertaining to research designs employed in these studies. These data are classified according to the previous four sections the research fit into and the type of research design employed (Campbell and Stanley[1]; Isaac and Michael[2]). Despite the limitations of this categorization scheme (e.g. few studies focus solely or primarily on correlates; program evaluation studies often employ experimental designs) there are some interesting and important observations associated with these data. It is readily apparent that researchers in the area of ecological literacy relied upon a variety of research designs. This is to be expected given the relatively wide variation in study purposes, problems and investigation modes. There were fourteen experimental and twelve theoretical studies, although the five program evaluation studies in the theoretical section employed some form of experimental design as well. In addition there were twelve descriptive studies and one which could be classified as historical.

A brief analysis of the combined experimental and program evaluation studies is revealing. While the total number of studies is not large, more than half (N=11) employed true experimental designs. Seven of the nine studies falling within the "Formal Setting" category employed true experimental designs, predominantly four group pre-post control group design variations (27, 96, 138, 267, 274, 288, 339). Similarly, four of the six studies in the "Mixed Setting" category employed true experimental designs (128, 295, 332, 341). As discussed in the previous section, three of the four "Non-Formal Setting" studies (44, 47, 143) were reported by the same group of researchers and were carried out on the same program. This should be taken into account when considering the table data observation that all four of the non-formal studies employed pre-experimental designs, raising the total number of pre-experimental studies to seven. The latter studies are problematic in that their designs did not control for variables (e.g. history, maturation, test bias) which could confound the effects of treatment variables. As a result, it is necessary to approach findings and conclusions of these studies with a cautious and critical eye.

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[1] Campbell, Donald T., and Julian C. Stanley, "Experimental and Quasi-Experimental Designs for Research in Education." In N. L. Gage (ed.), Handbook of Research on Teaching. Chicago: Rand McNally and Company, 1963.

[2] Isaac, Stephen, and William B. Michael, Handbook in Research and Evaluation. San Diego, CA: Knapp, 1981.

TABLE 1

Research Designs Employed in Ecological Literacy Research

Categories of Studies

Research Design	Predictors and Correlates	Formal Setting	Mixed Setting[1]	Non-Formal Setting	Total
True-Experimental	0	5	2	0	7
Quasi-Experimental	0	1	0	0	1
Pre-Experimental	0	1	2	3	6
Historical	0	1	0	0	1
Theoretical	0	7	2	3	12
A. Curriculum Development	0	2	0	1	3
B. Program Evaluation[2]	0	2	2	1	5
C. Instrument Development	0	3	0	1	4
Descriptive	1	8	0	2	10
A. Correlational	1	0	0	0	2
B. Survey	0	6[3]	0	1	7
C. Survey-Correlational Combined	0	2[3]	0	0	2

1. "Mixed Settings" refers to studies involving formal groups in non-formal settings. This same category meaning applies in Tables 2,3 & 4.
2. "Program Evaluation" refers to the testing of developed curricula and/or programs. Of the five, four rely upon true-experimental and one upon pre-experimental testing design.
3. In each case, a dissertation and associated journal article were counted as separate studies causing a slight inflation of the figures.

There is also an apparent emphasis upon research in formal settings. Five of the seven curriculum and instrument development studies were undertaken with formal settings in mind (97, 131, 177, 293, 350), although the results appear to be equally applicable to mixed and non-formal settings. Similarly, nine of twelve descriptive studies were conducted in formal settings. Of these nine, seven were survey type research studies (59, 174, 278, 330, 342, 482, 496). The absence of both of these types of studies in mixed and non-formal settings is easily noted.

Early sections of the text of a well-prepared research report should be devoted to establishing the rationale(s) associated with the study's purpose, problem(s) and questions or hypotheses from the literature. Evidence of this is usually apparent in the character of the study's literature citations. Table 2 provides an overview of how extensively the researches cited the literature used to guide these aspects of their studies. Data from dissertations are not reported in this summary, because they commonly devote whole chapters to literature reviews. Of the remaining studies, slightly more than half cite eleven or more references. As an indicator of research quality, literature citations do not appear to indicate any major weakness of the research reported in this synthesis.

TABLE 2

References Cited[1]

	Categories of Studies				
Number of References Cited	Predictors and Correlates	Formal Setting	Mixed Setting	Non-Formal Settings	Total
0	0	1	0	1	2
1-5	0	2	0	2	4
6-10	0	4	0	0	5
11-15	1	4	0	0	5
16-20	0	0	1	0	1
21-25	0	1	1	1	3
26-30	0	0	0	1	1
greater than 30	0	1[2]	0	0	1

[1] Table 2 does not include the number of references cited in dissertations (N=17).

[2] In place of true references, the author listed more than 100 addresses of commercial book publishers.

Discussion

The body of research presented in this synthesis provides insight into many aspects of education for ecological literacy. Despite the fact that the research studies were organized and presented in five separate sections, it is apparent that many studies did not clearly fall into one but rather held implications for several sections. In several instances, these implications were briefly noted. For example, the two curriculum development studies (131, 293) were not only related to each other, but to several correlational studies (i.e., the relationship of ecological knowledge to conceptual awareness of issues) and to several program evaluation studies (i.e., regarding the methods for organizing and presenting ecological concepts within program materials).

The findings presented in this synthesis offer some valuable insights in several major aspects of education for ecological literacy: teacher preparation, curriculum development, instructional methods and settings, variables which affect the process and effectiveness of learning and assessment methods. In the area of teacher preparation, ecological units can be effectively added to methods courses (e.g. elementary science), although addition in and of itself does not appear to be sufficient. It seems also that teachers need further training in curricular and instructional aspects of ecological concepts in order to be able to facilitate more effective learning and application (e.g. via an EE unit, a unit on their ability in and attitudes towards teaching these concepts) (138, 267). Childress' study (59, 278) indicates that this may be crucial, as teachers are most often responsible for both EE curriculum development and instructional preparation. Several studies suggest some of what these ecology units and unit supplements should include:

a. Basic environmental and ecological concepts (131, 178),

b. Curriculum development considerations such as content structure (293), and responsiveness to learners' cognitive development and style (325, 298) and

c. Instructional preparation considerations such as the availability of materials (266, 285, 330, 332, 341, 342, 480, 482, 491), of methods and approaches toward integrating indoor and/or outdoor methods (44, 128, 143, 270, 288, 295, 334) and of outdoor sites which may be used to foster the acquisition of ecological concepts (78, 341, 480, 481). The studies reviewed suggest more specific aspects of or limitations associated with a host of curricular and instructional variables. For example, in and of itself the use of simulation exercises does not appear to be an effective instructional method for fostering concept acquisition. However, the use of advanced organizers in conjunction with outdoor instruction does appear to be an effective instructional strategy.

With respect to instructional and learning-related variables, the research findings are mixed. There are some indications that there are experiential, cognitive, affective, behavioral and demographic variables which are related to the acquisition and/or application of ecological concepts. It appears that there may be interactions among these types of variables which contribute to concept acquisition:

a. Positive teacher attitudes toward the outdoors, the environment and ecological concepts (138, 266, 267, 332, 480);

b. Effects of structured and unstructured out-of-the-classroom experiences on knowledge and related attitudinal gains (100, 292, 295, 332, 341, 481);

c. Balances between cognitive and affective approaches (295, 339);

d. Effects of residence, gender, age/grade and social background on the learning and/or status of students' concepts of ecology (292, 295, 298, 325, 350). However, conclusions can only be tentatively and cautiously drawn, as the findings of research reports for these variables are mixed (44, 177, 185, 266, 295).

With respect to the application of ecological concepts, a few studies provide guidance, although there is a recognizable need for more substantial research here. Only two studies attempted to directly assess cognitive-related application skills as outlined by Bloom et al.[1] and both sets of findings appear to be inconclusive (97, 128). Though there were other studies which focused on issue-related application topics, the findings are only slightly more conclusive (96, 97, 100, 185, 198, 292). Of special interest are studies by Moore (185) and Ramsey and Rickson (198). The former utilized theoretical and applied ecologists in developing a 22 item issue-oriented multiple choice test to assess comprehension of 10 basic ecological concepts, while the latter detected a statistically significant correlation between knowledge of concepts and knowledge of trade off costs.

Only one study attempted to assess the application of knowledge in a behavioral setting (341). The researcher reported finding no statistically significant relationship between the two variables. However, he did suggest the need for the refinement of relevant behavioral measures and for the conducting of additional research.

Another important aspect of research on ecological knowledge is the development and use of valid and reliable assessment instruments. Four instrument development studies were identified and discussed (47, 97, 177, 350). Of these, only one focused exclusively on the development of a content-valid test of conceptual knowledge (350). Two other abstracted studies focused upon the development of valid and reliable tests to assess conceptual knowledge as part of a broader knowledge and attitude assessment package (47, 97). The fourth study focused on the development of unobtrusive measures of attitudes toward ecological concepts (177). Many additional studies, including surveys (185) and dissertations (266, 267, 274, 278, 288, 295, 298, 332, 335, 339, 341) involved the development or adaptation of assessment instruments.

Research in formal settings accounts for the bulk of studies reviewed. The findings with respect to indicators of research quality suggest that the majority of these studies are of sufficient quality to warrant the drawing of conclusions and tentative generalizations.

There were far fewer studies which fit into the mixed setting (N=6) and non-formal setting (N=7) categories than in formal settings category. In general, the mixed setting research appears to be of a fairly high quality: predominantly experimental (4/6) vs. pre-experimental (2/6) designs; and at least fifteen cited references for non-dissertation studies (2/6). As a result, conclusions and generalizations drawn from the findings of these studies appear to be relatively sound.

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[1] Bloom, Benjamin S., Max D. Englehart, Edward J. Fuerst, Walker H. Hill, and David R. Kratwohl, Taxonomy of Educational Objectives I: Cognitive Domain. New York: David McKay Company, 1956.

In comparison, the non-formal setting research appears to be generally weaker than formal and mixed setting research. While significance levels were generally reported, there are recognizable weakness in study design (e.g. four pre-experimental designs), in the citing of relevant literature and in the reporting of estimates. Concerning the latter indicator, only one study (47) included both estimates, one included validity estimates and should have included both (78).

This review of data provides a general picture of the character of and needs for research related to ecological literacy. Regarding the categorization of studies by type and setting (Table 1) there is a recognized need for research in nearly every area. There is also a recognized need for valid and reliable measurement/assessment techniques to serve each of the discussed research settings. With respect to mixed and non-formal setting research, investigators have indicated the need for tighter research design controls to guide treatments and the use of instruments (143) as well as for more potent, naturalistically-oriented unobtrusive measures (341).

Finally, it can be said that despite the relatively long history of education for ecological literacy, there are apparent needs for a substantial volume of research of high quality as a basis for improving related educational theory and practice.

III. Environmental Education Research Related to

THE AFFECTIVE DOMAIN

Lisa Yount Specca[1] and Louis A. Iozzi[2]

Research Contributing to Attitude and Values Theory

Values and attitudes theory research involves studying the processes of how individuals form attitudes and values as well as the ways individuals perceive those attitudes. Sometimes, research becomes confused when measuring self-perception. Lowenthal and Riel concluded from a study based upon self-perceptions of environments that what we think we like about a certain environment and what we actually like are often different (164). Russell and Mehrabian suggest there exists a direct relationship between perceived pleasantness of a setting and desire to affiliate with that setting (205). Variables such as perceived crowding levels may also influence the pleasantness of a setting for different individuals (169).

The formative processes of environmentally concerned individuals are varied and multidimensional (230, 53). Attitudes and preferences may differ significantly between very similar groups with respect to conservation and environmental issues (157). Several beliefs and knowledge levels influence the behavior and attitudes of environmentalists. Finally, attitude factors and correlations which are highly significant in the short-term may vary considerably in the long-term (39, 130).

Strength and nature of attitudes relating to environmental concepts were found to be related to previous knowledge of issues, agreement with peer's attitudes and amounts of exposure to information (224). Miller found, among other things, that a significant amount of our environmental attitudes are formed in elementary school years (179). The attitudes of eighth graders appears more stabile than that of fifth graders; and eighth graders do not differ significantly in their attitudes from the general adult population (121, 179). In other studies it was found that while education appears to be a very strong factor in producing environmental concern, membership in environmental oriented youth groups such as 4H, Boy Scouts, and Girl Scouts, has no significant effect upon later adult environmental attitudes according to Ellis (369). The longevity of positive attitudes developed in school children has only been confirmed over a two-year period by Alaimo and Doran (3).

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Piagetian models have been used to score attitude responses in children. Miller's research indicated a move from simple, concrete thinking to more complex and abstract thinking when environmental concepts are considered (179). Even when informational levels are low concerning environmental issues, Young found the vast majority of children hold a favorable concept of wilderness (261). Bohl concluded from a nation-wide cognitive and attitudinal study of high school students that the average high school student has a limited amount of cognitive knowledge of environmental information. He further determined that attitudes are essentially "learned responses" and should not be taken as true beliefs (273). As knowledge increases, perhaps through completion of courses related to the environment, individuals strengthen their basis for more strongly supported attitudes (310). In fact, children attaining high informational levels preferred high attitudinal levels and answered issue related questionnaires with more confident, polar answers than did children with lower informational levels (65).

Factors of education and environmental concern are often strongly correlated (48, 198). Exposure to intense environmental instruction significantly effects attitudes toward the environmental issues presented (427, 143, 55, 44), and knowledge of and concern for the environment are significantly (but less strongly) correlated with willingness to take action (225). This escape from self-involvement manifests itself most when restrictions on personal freedom are implied (21). In two statewide (North Carolina) surveys conducted by Marsh and Christenson (176) designed to measure support for economic growth and environmental protection, results differed significantly prior to and after the fuel price inflations of 1973. Respondents supported environment when fuel was cheap and employment high but changed to supporting economic growth when prices jumped and jobs were lost. Hence, self-interest appears to be a powerful factor of influence in most adult attitudes. Young children are also self-interested but in a more egocentric, immature perspective. They are most concerned with the effects of environmental problems upon their families and themselves (249). On the other hand, studies of High School students have found little significance of self-interest in environmental decision-making processes (201).

Demographic factors (such as age, gender, SES, ethnic background, lifestyle, social class and place of residence) have been investigated and correlated within theories of attitude formation. Page hypothesized that different ethnic groups will hold differing affective responses to the same visual stimuli but studies revealed a more significant correlation between members of a similar social class than of similar ethnic groups (326). Life style was significantly related to environmental preference in a study by Biswas (272). Buttel found the factors of age and place of residence to be far better predictors of support for environmental issues than factors of social class, income or education (51). There appears to be little significance in attitudinal differences between urban and rural dwellers with respect to general environmental issues and concern (198). For specific environmental issues, significant differences exist for urban dwellers (154). Specific environmental issues also provide for significant differences in attitudes as the basis of SES, gender and age (269). However, Ayers and others have found no significant differences in awareness of issues like the energy crisis with respect to gender (13).

Overall, the research appears divided upon the effects of varying demographic factors in respect to attitude formation. More extensive study seems necessary in this area.

Sociopolitical attitudes are more reliable as predictors of environmental concern than political party affiliation (50, 52). Sharma et al. found pollution control less a political issue than a topic of conversation. They also found the usual political processes and involvement ineffective in generating anti-pollution sentiment (215). This lack of political motivation for pollution control was evidenced in a study by Holland in which mayors of Riverside, California feared the findings of a smog study would damage the city's reputation. Communications to politically active environmental groups mostly contained information of avoiding-type behavior and ignored active behavioral suggestions. The result was an ineffective program to reduce air pollution in the city (117). Part of the ineffectiveness of political processes in generating support for environmental concern may center around perceived powerlessness of individuals. Powerlessness and anomie were found to interact to explain opposition to pollution control (189). Such alienation is a significant predictor of lack of environmental support which cannot be explained by SES or demographics (189).

Research in attitude and values theory has concentrated most heavily upon the investigation of dynamic formative influences of attitudes held by environmentally concerned individuals. Demographic factors, prior beliefs, information exposure and conservation behaviors have all been correlated significantly with positive concern for the environment. The way individuals perceive their environment is influenced by their level of moral development as well as their individual attitudes (302). Iozzi, using the theoretical model of Lawrence Kohlberg, found that the stages of moral reasoning vary within individuals. Subjects were found to reason at different moral stages when confronted with different moral issues. This variation in level of judgment exists as a result of the factors which also vary attitudes. Specifically these are knowledge, interest, exposure and amount of self-interest (302, 224, 286). The responses to moral values also varys among different types of individuals. Disposto found college educated individuals to be more emotionally involved with environmental value issues than actively involved (286).

Responses to environmental issues may eventually manifest themselves in permanently altered attitudes or initially in mood shifts. A study conducted using visitors to Audubon Society Wildlife Sanctuaries revealed significant positive mood changes during the course of a visit to the nature center (184). Responses to environmental issues are related to level of moral judgement, attitudes, previous experiences and perceptions. The effects of such responses vary with individuals and are observed in changed attitudes, more positive moods, or in environmental action.

Summary:

In summary, research contributing to Attitudes and Values theory has determined a complex, multidimensional set of significant factors which influence the formation and stability of environmental attitudes. Education is strongly correlated with concern for the environment.

Suggestions have been made that environmental attitudes are learned as early as elementary school and are reinforced through higher education. Self-interest is negatively correlated with environmental concern when restrictions upon personal freedom are implied. Less definitive results have been presented for the influence of demographic factors such as age, gender, SES, and place of residence upon formation of positive environmental attitudes. Political party affiliation is not a significant factor in attitude formation but sociopolitical ideology is significant. Levels of moral judgement and reasoning have been found to vary for individuals when confronted with environmental concerns. This variation occurs as a result of the same formative factors influencing attitudes.

Prevailing Attitudes of Various Publics

Research has discovered much concerning formative processes of environmental attitudes and in so doing has documented the prevailing environmental attitudes of our society. In general, Althoff and Greig found positive concern for the environment coupled with weak personal commitment, a general distrust for governmental remedies and lack of support for governmental pollution control policies (7). Three distinct groupings of attitudes appear with respect to energy conservation and technological remedies for energy shortages: high enthusiasts, ambivalent, low enthusiasts (8). Most respondents to surveys felt that the environmental crisis and energy crisis were exaggerated (8, 79). There appears to be a widespread belief in the technologic ethic, according to Donahue, Olien and Tichenor. This support for technology is coupled with general reluctance to accept severe restrictions upon energy and natural resource use (79). Over time, familiarity with issues and concern for remedies was found to decline (79). A substantial decline in public support for the environmental protection movement was observed from 1970 (275, 83). Dunlap and Dillman proposed that people feel that the problems of environmental degradation are being remedied by laws and regulations enacted during the 1970's (83).

Another study attempted to identify and explain the correlates of environmental concern. It was found that age, education, and political ideology were most highly correlated with environmental concern (499). Heberlein and Block (461) determined that there was a strong tendency for people to have consistent beliefs about environmental issues and, moreover, there was a consistency between beliefs and behavior.

Apparent lack of awareness of the status of environmental degredation remedies was observed by Murch through a North Carolina survey (187). He concluded that subjects believed there could be solutions to environmental problems but had no clear cut ideas about alternatives. Murch implied better publicity would raise levels of awareness (187). Buttel suggests the political-economic elites may have succeeded in squelching mass media efforts to mobilize the environmental movement and its threats to economic expansion and productivity (275). Awareness of environmental degredation runs high on a global scale and erodes as the reference points become more local. Murch suggests people are reluctant to acknowledge defects in their own surroundings (187). Perceptions in English society are similar to our own. The British public was found to have considerable awareness of air pollution problems and corresponding legislation but a vague attitude toward remedies (251).

The general public's vague sense of understanding for solutions and control of environmental degradation may stem from the yet unresolved placement of responsibility between industry and government. Politicians remain safely in the middle of the road on this issue while most people indicate support for state level responsibility and control (6). Support for specific governmental policies designed to curb pollution and natural resource waste are not as favorably viewed. Only 50% of people surveyed in Illinois by Simon approved of high political priority being placed upon environmental issues (217). Favorableness was significantly associated with younger, more educated, politically active and politically liberal individuals (119, 108, 82, 235, 70). Contrary to popular belief, mayors were not shown to hold widely divergent viewpoints on community and environmental conditions from environmental activists (36). Mayors tended to seek high environmental quality standards but implied that lack of funding was the largest obstacle in achieving such standards (279).

To further add to confusion concerning attitudes of the general public toward environmental quality, McTeer found that children (students) ranked environmental objectives significantly more important than did adults (parents, teachers and administrators) (172). While all age groups displayed concern for environmental quality, youth's high level of concern sharply contrasted with adult's moderate concern (73). A British study indicated that students had a significant understanding of environmental concepts, a poorer command of environmental knowledge and held positive attitudes toward the environment (334). Children's enthusiasm for environmental quality varies with age level and knowledge acquired but all age levels perceived economic reasons as the "primary cause" of environmental problems (264).

Hungerford and Rubba (463) compared and evaluated the views of four different groups on prominent worldwide environmental issues. The groups included Illinois junior and senior high school students, elementary and secondary school teachers, readers of an EE newsletter, and a group of EE trainees. It was found that the four groups agreed on only one issue as being "most important" worldwide - energy consumption. Consistency in opinion was strongest between teachers and students, and between newsletter readers and EE trainees.

Environmental and Civic Organizations differ with respect to attitudes of and involvement with environmental issues (153, 323). Groups such as the National Wildlife Federation, Sierra Club, Wilderness Society, Environmental Defense Fund and Environmental Action believed the energy crisis to be serious. Ten percent of members held deep ecological views and fifteen percent were sympathetic to ecological views (183). Sports and hobby clubs were less likely to have leaders who felt environmental concerns were within the scope of their club's goals (153). Other community groups expressed interest in environmental quality and took action such as collecting money, inviting guest speakers, collecting litter or writing to political leaders (153). Overall, environmental groups scored higher on instruments designed to measure principled reasoning of ecological issues (323). In one Wisconsin study, the League of Women Voters demonstrated considerable comprehension of difficult environmental concepts such as evolution, population and environmental adaptations (185).

Recreational users of the environment hold attitudes related to their participation within the environment (147). Many recreational uses are consumptive (hunting, fishing) and elicit different attitudes than appreciative users hold (77, 105, 84). Association between environmental concern and outdoor recreation is greater for appreciative activities than consumptive ones (84). Attitudes toward recreational facility development and quality are also related to type of recreational activity. Users of campsites which are highly developed have more favorable attitudes toward development of facilities than toward wilderness preservation (258). Swimmers may perceive water quality very differently than boaters or fishermen. Attitudes toward allocation of federal resources for environmental maintenance will differ as recreational uses differ among individuals (177). Attitudes toward education in marine environments differ with use of the environment. Proximity to marine environments correlates with desire to include marine ecosystems study in curriculum of public schools (411). Campers attitudes are differently influenced by punishment, reward and factual themes of communication. Littering habits were significantly effected only by punishment themes of communication even though attitudes toward litter were universally negative among campers (175). Finally, recreational uses may influence career decisions in young people involved in YCC activities (237). The great variation in environmental attitude among recreational users of the environment is a reasonably clear reflection of the importance of self-interest upon attitude formation.

Interest in wildlife may influence attitudes in favor of protection of the environment. Knowledge plays a relatively minor role in predicting attitudes toward wildlife when compared to participation in wildlife preservation activities (313). Two types of subjects were classified in a wildlife study by Erickson, the protectionists and the reductionists. Protectionists favored wildlife habitat preservation and placing limits upon hunting while reductionists, such as farmers, viewed wildlife from a self-impacting perspective; that of crop damage (90). A 1972 State Fair exhibit examined the attitudes that people held toward wolves and attempted to determine if information at the display induced more moderate views toward wolves (137). Overall, a favorable attitude prevailed with respect to preservation of wolves (137, 91). A study conducted by Bart indicated that animals on endangered species lists, i.e. wolf, alligator, hawk are ranked low in a hierarchy of preferred animals. Negative attitudes toward endangered species could be altered by placing greater emphasis upon them in public school curricula (20).

Environmental attitudes may differ among different interest groups as well as within different ethnic groups. In a study by Hershey and Hill racial differences in attitudes toward the environment represent a Black sub-culture in America. Whites were found to hold more complex definitions of pollution, were more likely to disagree that pollution "just happens" and were more likely to see pollution as a societal problem (115). A survey of Black student opinion by Kreger suggests that Blacks are not interested or concerned with ecological problems. Social environment was rated higher than concerns for the physical environment by approximately 60 percent of the students surveyed (152). In another interesting study, Cutter (445) found that low SES Black communitites had higher levels of environmental concern than did high SES White communities. This finding differs from other researchers cited. Finally, Black and Chicano college students expressed resistance to population control inferring that it was a version of genocide. Black and Chicano students were also less likely to use artificial birth control methods (41). More research is necessary to confidently examine the variables of race upon environmental values and attitudes (41).

Place of residence seems to be a significant factor in environmental attitude formation. Buttel and Flinn hypothesized that anti-urban sentiments are more closely associated with environmental concern than is agrarianism (yearning for self-sufficiency) and found upper middle class persons most highly in agreement with their hypothesis (49). Smith and Alderdice found no significant differences between urban and rural atitudes toward national park roles (218). When farmers attitudes were correlated with those of city dwellers to determine urban-rural differences in attitude toward environment, initial study implied urban dwellers held a greater concern for environmental quality (206). Extension of studies investigating farm vs. urban attitudes indicates that the apparent lack of concern on the part of farmers is probably due to a utilitarian outlook on the environment. Further investigation of urban-rural differences should include extractive vs. non-extractive occupations as an independent variable (238).

Summary:

In summary, prevailing environmental attitudes and values appear to be declining with respect to support for environmental protection. A general lack of confidence in governmental control policy contrasts sharply with a desire for governmental action and responsibility for environmental quality. Lack of awareness may actually be lack of acknowledgment of environment problems close to home. Encouragingly our youth remain optimistic about solutions to environmental problems in spite of their limited environmental knowledge. Civic organizations take a less active role in environmental issues than environmental organizations and are less supportive of deep ecological values. Attitudes toward environment within groups of recreational users of the environment differ as the activities they participate in differ. Appreciative activities foster more positive environmental concern than consumptive ones. There appears to be a prevailing negative attitude toward endangered species in spite of self-perceptions to the contrary. Ethnic factors influence attitudes toward the environment in confusing ways suggesting further research is needed. There appears to be an emerging Black sub-culture which is more concerned with our social environment than our physical environment. Finally, the research on differences in attitudes towards the environment between urban and rural dwellers are, at best, vague.

Instrument Use and Development

Instrumentation utilized to measure environmental attitudes and values is of primarily two types: surveys and questionnaries. Descriptive research correlating the various factors thought to be significant is the most common format. Because of the design of the research, results are usually correlational in nature. As is the case with many investigations, cause and effect relationships are also vague and elusive within the affective domain; hence descriptive and correlational research seems to prevail.

Variations of Likert-type scales are popular instruments for assessing attitudes (220, 122). Knopp used a Likert-type instrument to develop baseline data of river users preferences for management decisions (148). Likert type questionnaires were developed to assess attitudes toward resource use and management (144, 255). Hummel, Levitt and Loomis developed a Likert-type survey to determine if analysis of consequences would change favorability attitudes in residents. Consequence analysis through this instrument was deemed successful in modifying attitudes (208). A Water Concern Scale utilized a 19 item Likert scale to assess the concern of residents of Florida toward water conservation (252).

Other instruments have also been developed to assess attitudes. Survey of Oceanic Attitudes and Knowledge (SOAK) is a popular tool for assessing marine knowledge (100, 292). In addition, Bart describes a two-choice questionnaire to determine students' attitudes toward animals. Collins has expanded Bart's scale to include a neutral category and suggests the new scale is far more sensitive (68). Instruments have been developed to assess attitudes toward population (253) and to test attitudes toward broad environmental issues (34). An Environmental Attitude Scale (EAS) was developed by Kostka to assess the needs of sixth graders and was combined with a Nature Activities questionnaire (NAQ) to more fully understand the student's evaluations of activities (151). An unobstrusive survey was developed by Moyer to determine environmental attitudes with respect to pollution, population and ecological relationships (177). Weigel developed the Environmental Concern Scale (ECS) and suggested uses as a reliable and valid research tool (254). The use of Transactional Analysis was employed by Cohen and Austin to determine the items useable on an environmental attitude instrument (66). Researchers have agreed that a semantic differential instrument is an efficient and sensitive means of assessing environmental attitudes (145, 343, 289). The semantic differential technique is often utilized in combination with Likert-type and other attitude scales to explain environmental behaviors and attitudes (289). Other instruments have been developed to assess awareness of environmental issues: The Columbia Broadcasting System (CBS) sponsored an expanded version of National Environmental Test coupled with the Environmental Education Test and the Environmental Attitude Inventory (97, 127).

Two values assessment instruments have been patterned after Rest's Defining Issue Test. First, the Environmental Issue Test (EIT) was developed by Iozzi to determine the levels of moral and ethical judgement with respect to environment issues (132). The Environmental Issues Attitude Defense Inventory (EIADI) assesses the role that information and knowledge play in making value judgements in the process of moral development (145). The Variation in Value Orientation Schedule (VVOS) assesses values orientation of students as compared to their parents and teachers (314). Baker, Doran and Sarnowski utilized the Study of Values (SOV) inventory and the Environmental Value Inventory (EVI) to determine the significant relationships between environmental values and general values (16).

Three instruments have been developed to assess personal preferences. The Environmental Preference Test (EPT) was coupled with the Verification

Frequency Simulation (VFS) to determine environmental preferences and assess littering habits (345). Fazio and Dunlop investigated value preferences in environmental chemistry with an instrument called Environmental Chemistry Value Preference (ECVP). Calvin, Dearinger and Curtin developed a semantic differential scale to evaluate human experience and preference for the natural environment (154).

Opinionnaires and surveys were utilized by Kuhn and Peterson in assessing differences of opinion between students regarding energy and resource use respectively (155, 194). A survey of public and leadership attitudes was conducted door-to-door by Louis Harris and associates to determine attitudes toward nuclear power development. A second survey was gathered after the fuel prices skyrocketed in 1976 to determine any change of attitude and confidence in nuclear power (381, 382). A study was conducted by Newsweek magazine between 1969 and 1975 to determine if there was a relationship between frequency of media coverage of pollution compared with public concern, reported quality of the environment, of federal obligations of money. Newsweek was found not to be reliable as a barometer of the three factors (268).

Two instruments have been developed to survey views of environmental quality: one global, one local. Dunlap and Van Liere developed the New Environmental Paradigm to determine if general world views toward environment are widely accepted by the public (85). Carp, Zadowski and Shokrkon developed an instrument to survey residents of the Bay Area Rapid Transit system (BART) for perceptions of environmental quality within their neighborhood (56).

The effectiveness of environmental education upon attitudes toward environment has been determined through an instrument called the Environmental Knowledge and Opinion Survey (EKOS) (123, 124). Field experiences have been evaluated for effectiveness by using Billing Environmental Attitude Assessment Instrument (BEAAI) in combination with a Checklist of Observed Affective Behavior (COAB) (351). Positive changes in environmental attitude have been measured with Markovits Inventory of Environmental Attitudes (MIEA) after participation in an outdoor education program (319). A Q-Methodology was used by Kinzel to determine the attitude shift after a Youth Conservation Corps experience (311). Effectiveness of teacher workshops covering environmental information on improving teacher values toward environment was assessed by using the Allport-Vernon Study of Values (SOV), the Levit-Morrison Test of Basic Assumptions (TBA) and an Environmental Awareness Study (EAS) (165).

Teaching Methods and Curriculum Implications

Research in environmental attitudes theory has led to experimentation and testing of various methods of teaching and curriculum, opportunities. Howell and Warmbrod compared the text Introduction to Environmental Protection to another study manual using the Solomon Four Group Experimental design. They found no significant differences in attitude toward environmental protection between the groups (126). Iozzi evaluated "Preparing for Tomorrow's World" with respect to its ability to induce growth in moral and ethical reasoning in science students. The program effected significant growth in both the cognitive area and moral and ethical reasoning abilities of the treatment group (133). Wilson and Tomera incorporated affective materials associated with environmental literacy into a biology curriculum and observed significant shift in student's attitudes toward the environment (256). An environmental curriculum opportunity (ECO) project was instituted in one school district in Iowa and was compared to another district with no environmental curriculum. The results of evaluation indicate significant differences existed between the school systems in favor of project ECO (75). A model environmental education program including a resident outdoor field experience was compared to traditional classroom presentation of information with confusing results. Field experience had no significant effect upon attitude formation or knowledge; however, instrument validity was not reported (277). Research generally tends to support the position that educational programs have a positive impact on EE values and attitudes of children (444, 462, 469).

Outdoor educational experiences have proved themselves valid methods for encouraging positive environmental attitudes in students as a pre-cursor to an ecologically enlightened society (134). Outdoor education participants felt positive about experiences, more realistic about goals and more satisfied with themselves in a psychological benefits study conducted by Kaplan (141). A group of disturbed teenagers participated in an intense 19-day outdoor experience and felt exposure to the experience left them more self-confident, more agreeable with parents and teachers, and less prone to deviant behavior. These teenagers remained more internally oriented six months after the experience (374). Sixth grade students have been found to benefit significantly by increasing positive attitudes when exposed to outdoor education programs (417, 271). Andrews found significant interrelationships among the cognitive, affective and behavioral domains of students involved in an outdoor education program. He discovered a direct relationship between involvement in outdoor education and attitude toward concepts related to activities (266). A winter ecology program developed by Picker was evaluated as teachable, inexpensive, nonsexist and high in student involvement by a panel of experts. The program brought about significant gains in students in both the cognitive and affective domains in students on environmental issues (332). Rossman and Ulehla determined that inclusion of outdoor, undeveloped areas into a person's scope of activities can bring rewards unavailable in developed areas (203). When leaders in environmental organizations were surveyed for reasons as to why they chose environmental professions, the most frequent response included youthful outdoor experiences and activities (231). It appears that the inclusion of outdoor activities into traditional curriculum is justified by the volume of positive research to date.

Outdoor educational programs are only one type of activity which significantly influences the way students learn and perceive their environment. All field trip experiences appear to be effective, especially in combination with advanced organizers as study guides (295, 309, 386, 69, 109); attendance at youth camps such as YCC can also result in significant positive changes in environmental knowledge and attitudes (279). Environmental education activity-oriented modules have resulted in more positive environmental attitudes in seven year olds (320). Environmental education of all types was ranked highly important by teachers but transportation and funding were cited as primary problems (168).

Several studies have found that teacher workshops are successful in encouraging teachers to include environmental topics in classroom instruction (394, 240). It was also found that teacher attitudes can be significantly altered as a result of values-oriented environmental education programs (435, 453). More importantly, the students of participants in these value-oriented units also show significant alterations in environmental attitudes (267, 138). Different methods of teacher training were insignificant in attitude formation; however, active involvement of teachers in the development of resource material was more significant than passive participation in a workshop (344, 305). An environmental "teach in" can cause a significant shift in attitudes toward environmental problems, but enthusiastic participants along with fully cooperative administrations are necessary for effective results (161, 125). Both science teachers and social studies teachers felt that value issues have a legitimate place in both science and social studies curricula. Teachers in both groups believed that they had the knowledge of teaching strategies and overall preparation to deal with such issues in the classroom (455).

Different approaches to teaching environmental issues have been tested by researchers. In a study comparing an inquiry method to a values-oriented approach to environmental education, both approaches were found to be successful in increasing knowledge while values-oriented approaches were superior for increasing affective areas (421). A guided discovery-expository approach concerning use and misuse of water resources proved successful in shifting values in a more positive direction in 6th grade students (2). Studies by Bloom (438, 439) indicate that an open-ended inquiry method of instruction has a positive impact on the affective domain. Ruth and Hodgson explored the contributions that perception training makes to the quality of sensory information given in a written description of an environmental hike. Those children receiving perception training spent more time reflecting on the experience and referred to more sensory stimuli in their written reports (204). Rajeski examined how children develop internal "representativeness" of the natural world using a developmental psychology model. He concluded that environmental subject matter should be progressively organized to take into account childrens' new interests of viewing the world and organizing knowledge. EE learning experiments should begin in the early primary grades (490).

Several interesting methods for teaching environmental education were investigated. These include simulations and games. Dunlop found the effects of an energy simulator to be significant in changing student attitudes toward energy issues (86, 366). While simulation games were found to be not as effective as traditional teaching methods for teaching concepts and formulating attitudes, they do serve as models of reality and are more interesting to students (23, 274, 96). Puppetry was also used as a teaching method in a 4th grade environmental education class. Immediate results indicated significant increases in cognitive and affective areas but retention was not better using this novel aproach than traditional teaching methods (46). The effects of interdisciplinary environmental education classes are equal for all disciplines represented. No significant differences were found between science and social studies students after participation in an interdisciplinary class (37, 114). In some cases, attitude changes appeared to be greatest for interdisciplinary groups (114). In traditional classes, science students were more likely to agree that environmental quality is too often compromised with respect to economics than non-science students (111). Kudlas found that participation in a sportsman's biology class had a significant effect upon student's attitudes toward wildlife. Participants had greater environmental concern than non-participants (312). For those students not interested in science curriculum, Thiele developed a self-instructional method of making ecology more enjoyable by employing emotional and aesthetically appealing activities. College students participating in the testing of this approach showed significantly higher enjoyability ratings for the class than non-participants did (339).

Outside of traditional school settings, the media is the most common source of environmental education. The effects of Public Broadcasting messages upon school children was documented by Mehne. An experimental group viewed Public Broadcasting System (PBS) announcements and had positive changes in attitude toward twelve environmental concepts (321). Members in sportsmans organizations cited top sources of information to be television, magazines and books, respectively (262). Advertising campaigns have been proven successful even when the product advertised was rated "almost useless" by federal agencies (207). The media is a powerful tool for influencing attitudes. The Army Corps of Engineers released only favorable press releases relating to an anti-flooding project and influenced positive attitudes in the vast majority before information relating to drawbacks of the project could be determined (223). Stamm and Bowes suggested that full disclosure of advantages and disadvantages be required of all government projects in time for early public debate (223).

The effects of educational prompts on energy conservation were evaluated by Luyben. He found prompts to make a significant improvement in habits relating to energy conservation (166). Similarly, self-guided tours of caves were interrupted for two weeks by educational talks. This resulted in an increased interest on the part of tourists and their asking an increased number of cave-related questions (162).

Summary

In summary, the research indicates that environmental education methods can significantly affect attitude development of students. Specifically, outdoor education is valuable for forming positive attitudes about the environment, and field trips are successful methods for influencing perceptions and attitudes. Environmental education was rated highly among teachers, but money for trips and activities was a source of frustration. Workshops for teachers significantly effect the attitudes of both teachers and their students toward positive environmental concern. Values-oriented approaches appear to be more successful in shifting attitudes than do inquiry methods. Simulation games, while not as effective as traditional teaching methods, are highly motivational. Interdisciplinary education appears successful and science students are the most environmentally knowledgeable and concerned. Lastly, the media is a powerful tool for influencing attitudes.

Research Methodology

In preparing the above synthesis of "Environmental Education Research Related to the Affective Domain," no attempt was made to assess the quality of the research conducted. Judging research quality must include a consideration of the field in which the research is reported. In an emerging field such as EE, any attempt to compare qualitatively its body of research with that of more established disciplines or areas of inquiry would almost certainly lead to disappointment. However, this does not mean that shoddy research - if it exists - should be excused. Clearly, the better the research, the more accurately it will help to guide the further development of the field, and the more rapidly the field will grow and better respond to the needs of its constituents.

There are several indicators that can be used to provide an overall assessment of the quality of that research. These indicators include type of research design employed and the number of citations included as "References" in the research report.

Research Design

The percentage of studies and the research designs employed appear in Table 1.

TABLE 1

Research Designs Employed

Research Design	Percentage of Total
Descriptive Survey	55
Quasi-Experimental	14
Experimental	13
Correlational	10
Pre-experimental	7
Longitudinal	1
Total	100%

Clearly, the largest percentage of studies (55%) were "Descriptive Surveys" - a relatively simple research design - followed by "Quasi-Experimental" (14%) and "Experimental" (13%), the design considered by most researchers to be the most sophisticated. "Correlational" studies (10%) combined with "Pre-experimental" (7%) and Longitudinal (1%) collectively comprise the remaining 18% of the studies in the Affective Domain. Hence, for the most part, the research base in this area is largely of a descriptive nature.

It is sometimes useful to examine a body of research, particularly in an emerging field, and compare the designs employed in "earlier" studies with those employed in "later" studies. This technique enables one to determine if more sophisticated types of research designs are being utilized in the more recent studies and, therefore serves as an indicator of whether the field is progressing and/or becoming more sophisticated. Such an analysis was performed for the studies included in this chapter (Table 2).

TABLE 2

A Comparison of Percentages of Research Designs Employed 1971-1976 and 1977-1982

Research Design	1971-1976	1977-1982	% change (+/-)
Descriptive Survey	73	35	-38
Quasi-Experimental	9	20	+11
Experimental	8	17	+ 9
Correlational	5	15	+10
Pre-experimental	5	10	+ 5
Longitudinal	0	3	+ 3
Total	100%	100%	

A shift from Descriptive Survey types of research to more sophisticated types of studies is readily apparent. The percentage of Descriptive studies decreased by 38% while the more sophisticated designs showed appreciable increases. Clearly, the field of EE is moving from what some might describe as attempts to determine "what is happening" to more focused types of research designed to answer specific questions. Such a shift is good evidence that the field is beginning to define itself and is growing in sophistication.

Number of References Cited

The number of references included in the bibliographies of the research reports can be helpful in determining the overall quality of research studies. While no "clear cut" rule can be used to determine how many references should be included in a research study report, it would seem that one should be wary, at least, of the quality of studies that report no references, or, except in rare instances, 5 or fewer references. Table 3 reports the numbers (and percentages) of research studies according to 6 "categories" based on numbers of references included in bibliographies. Data for both "earlier" (1971-1976) studies and for more recent (1977-1982) as well as "Total" number of studies included.

TABLE 3

A Comparison of the Number of References Included in Research Reports Conducted During 1971-1976 and in 1977-1982[1]

Number of References Cited	1971-1976	%	1977-1982	%	% change(+/-)
0	10	11	0	0	-11
1-5	24	26	6	7	-19
6-10	25	27	25	28	+1
11-15	7	8	7	8	-
16-20	5	6	23	26	+20
>20	20	22	28	31	+9
Totals	91	100%	89	100%	

[1] Journal papers only included in this summary.

Again, when comparing earlier studies (1971-1976) with more recent ones (1976-1982), there is a positive shift in that the number of studies listing 5 or fewer references dropped appreciably while the number of studies in the 16-20 citations category increased significantly. There was little or no change in the number of studies included in 6-10 category and in the 11-15 category. One interesting phenomenon appearing in Table 3 is the rather high number of citations in the >20 category. While there is no readily apparent explanation for this, later studies still show greater increases in studies reporting large numbers of citations.

In conclusion, then, it can be stated that the overall quality of the environmental education research related to the Affective Domain seems to be what one would expect from a field of inquiry that is both growing and developing rather rapidly. That is, earlier studies seem to indicate a searching for direction and definition while later studies exhibit growth, increasing maturation, and development. These are all positive and healthy signs which indicate that the field of EE is certainly "coming of age."

IV. Environmental Education Research Related to

ISSUE AWARENESS

Randall L. Wiesenmayer[1], Maureen A. Murrin[2], and Audrey N. Tomera[3]

Introduction

For this chapter only research articles that explored cognitive aspects of public awareness about environmental issues were examined. Not included were research articles that focused strictly on affective dimensions of environmental issue awareness.

The diversity of the research questions proposed by this body of information required that the articles reviewed be categorized in a number of different sections. A substantial number of the 69 research articles reviewed here also appear in several other sections of this monograph since they contain information on a number of different topics. Environmental knowledge research was categorized according to the following outline. The number of studies reviewed in each of the four major sections is included in parentheses.

- Knowledge About Environmental Issues (25 studies)
    - Effects of Knowledge on Individuals
    - Demographic differences on Knowledge
- Sources of Environmental Information (19 studies)
    - Self-Reported Sources
    - Media Coverage
- Public Belief Systems Concerning Environmental Issues (62 studies)
    - Concern About Environmental Issues
    - Public Beliefs about the Nature of Environmental Problems
    - Public Beliefs and Perceptions about Solutions to Environmental Problems
- Teaching About Environmental Issues: Treatment Effects (14 studies)
    - The Traditional Classroom Setting
    - Outdoor Settings
- Discussion

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Knowledge About Environmental Issues

Twenty-five studies abstracted in Research In Environmental Education 1971-1980 (RIEE) examined the knowledge individuals had regarding environmental issues. These studies were divided into two major categories: 1) those that addressed how knowledge of environmental issues affected the individuals and 2) those that examined how individuals' knowledge varied demographically.

Effects of Knowledge on Individuals

Studies that assessed the influence factual knowledge of environmental problems had on fostering a pro-environmental position revealed a positive relationship between the two variables. In a descriptive study by Moore (483) of 219 science and non-science college students, a slight positive correlation ($r=.154$) was observed between the level of energy knowledge possessed by the students and their attitudes toward the environment. The researcher stated that the correlational results may suggest that greater information mastery encourages an environmental priority position.

Ramsey and Rickson's (198) study involving 482 high school students denoted similar findings to those of Moore (483). According to Ramsey and Rickson, increased knowledge regarding the nature and causes of pollution seemed to elicit more positive attitudes towards pollution abatement. The authors suggested that there is a circularity between knowledge and attitudes in that one does not solely cause or precede the other. Instead, knowledge may lead to an initial formation of attitudes which in turn may lead to further gains in knowledge.

A descriptive study by Young (261) entailing 503 telephone interviews in Illinois supported the findings of Ramsey and Rickson (198) and Moore (483). Young's (261) study showed a direct relationship between the level of subjects' knowledge about wilderness and their approval of the preservation of wilderness. Generally, those who knew most about wilderness, whether they had previously had a wilderness experience or not, were more favorable to the wilderness concept. The author concluded that efforts to inform the general public about wilderness would result in more favorable opinions about that issue, especially among those whose present level of knowledge was low.

The extent to which factual knowledge of environmental problems promotes a pro-environmental position may seemingly depend on how the people are affected by the problem resolution. Donohue, Olien, and Tichenor (79) found in their study of 428 adults that the most informed people had the strongest opposition to environmental restrictions. The authors implied that the apparent consensus toward environmental protection might well dissipate with enforcement of restrictions that strike at basic community values and beliefs about self-interest.

Another influence attributed to factual knowledge of environmental problems is that knowledge seems to strengthen feelings about issues. In Cohen's (65) study involving 454 high school students, in Bultena, Rogers and

Conner's (42) survey of 267 adults and in Young's (261) research with 503 adults, results indicated that informed people tended to be more polarized in their responses to questions concerning environmental problems, thus indicating a stronger opinion regardless of the direction of the opinion.

Demographic Differences in Knowledge

Other studies that dealt with factual knowledge of environmental problems examined how knowledge varied among demographically different groups, e.g. geographic region and gender. In a descriptive study by Hounshell and Liggett (123), environmental knowledge levels of urban and rural students were examined. Sixth grade students (n=1,881) responded to a 65-item "Environmental Knowledge and Opinion Survey." The instrument was validated and correlation coefficients were significant at the .01 level, providing evidence for instrument reliability. The results of this study indicated that the urban subgroup scored significantly higher ($p < .05$) on the knowledge scale than the rural students.

Other studies investigating differences in factual knowledge levels of environmental problems between urban and rural populations revealed opposite findings. Adult rural subjects (n=92) were found to have greater knowledge of two proposed flood control projects than adult urban subjects (n=170) in a descriptive study by Stamm and Bowes (223). Leftridge and James (160) also found rural students to be more knowledgeable of environmental issues than urban students. Their study indicated that regardless of the issue, geographic setting of the problem or amount of educational background of the subjects, rural students (10th and 11th graders) were found to be more knowledgeable of environmental issues than urban students to a statistically significant degree. The authors suggested that because rural students had greater opportunity to interact with the out-of-doors on a daily basis, they were more sensitive to perceived negative changes in their milieu than urban students.
Five studies examined the relationship between factual knowledge of environmental problems and gender. Hounshell and Liggett (123) found no difference in knowledge levels between sixth grade males (n=975) and females (n=906) on their "Environmental Knowledge and Opinion Survey." However, Cohen and Hollingsworth (67), Young (261), Eyers (290) and Fortner and Teates (100) all found males to be more knowledgeable about the environmental issues used in their studies.

In a descriptive study by Fortner and Teates (100) in which 787 tenth graders completed the "Survey of Oceanic Attitudes and Knowledge" (SOAK), males demonstrated more knowledge than females. The researchers inferred that since males participated in more recreational activities at the shore than females, they had more contact with the ocean and were more familiar with marine environmental issues.

Eyers (290) conducted a survey involving 4,821 tenth grade students in Australia to assess their knowledge of the environment and related issues. On fifteen of twenty-nine items where response differences by gender were observed, males outscored females on all but one item. On that item which dealt with world population, females outscored males.

In a descriptive study by Cohen and Hollingsworth (67) which compared male and female high school students' environmental knowledge levels, scores on an environmental information scale were used to identify high (n=84) and low (n=116) environmental information sub-groups. There were significantly more males in the high information group and more females in the low information group.

Young (261), whose study was previously discussed, attributed the higher level of knowledge possessed by males to how people gain information. He suggested that information about wilderness is acquired through informal methods and that it may not be as prevalent a topic of conversation in the informal female group as it may be among males.

Other demographic variables that were found to account for variance in factual knowledge included age, education and income. Bultena, Rogers and Conner (42) found in their study of 267 adult respondents that those who knew less about environmental matters were people over 70 years old, individuals whose annual income was less than $5000 and citizens who had no more than a high school education.

Young's (261) findings were also very similar to those of Bultena, Rogers and Conner (42). According to Young (261), those who knew the least about wilderness were those with less than a high school education, those whose annual income was less than $12,000 and those over 65 years of age.

An individual's proximity to a particular environmental problem was also found to account for variability in environmental knowledge. Residents close to an affected area or citizens who are directly influenced by an environmental issue possessed more knowledge than those more distant from the issue (42,100).

High socioeconomic level students tended to be more informed than students from low socioeconomic levels (42,322), and Caucasians were better informed than non-Caucasians (100,261).

Summary - Knowledge of Environmental Issues

The following generalizations can be drawn from the results of the research on environmental knowledge reported in this section.

1. The more information people have concerning an environmental issue, the more likely they are to manifest a pro-environmental position.

2. Environmentally informed individuals tend to have stronger feelings about environmental issues regardless of the pro or anti-environmental nature of these feelings.

3. Rural subjects are generally more knowledgeable about environmental issues than are urban subjects.

4. Males tend to be more knowledgeable about environmental issues than females.

5. People over the age of 65 generally know less about environmental issues than those under the age of 65.

6. Caucasians are more knowledgeable about environmental issues than individuals representing non-Caucasian racial backgrounds.

7. High socioeconomic status individuals are more knowledgeable about environmental issues than those of a low socioeconomic status.

Sources of Environmental Information

Nineteen of the studies abstracted in the RIEE investigated sources of environmental information. These studies can be further categorized as (1) studies investigating self-reported sources of environmental information, and (2) media coverage of the environment and environmental issues.

Self-Reported Sources

Among the ten studies that explored self-reported sources of environmental information, five looked at student populations (primary and secondary grade school children), while the remaining five examined adult populations. The five student investigations seem to indicate that the media, particularly television, are perceived by the majority of the students in these studies to be their primary source of environmental information. There was evidence in two of these studies, however, that students might see school as a more important source for environmental information if they had more exposure to this source.

In a study of 615 seventh through twelfth graders from western New York, Alaimo and Doran (4) listed five possible sources of environmental information (TV, science classes, magazines, parents, and newspapers), and asked whether or not each was a source of environmental information for the students. Television received the overall highest response rate. However, students in higher grade levels also indicated that their science classes were sources of environmental information, with 9th, 11th and 12th graders responding (almost unanimously) to both television and science classes as sources of environmental information. Magazines, parents and newspapers generally all received lower ratings than television and science classes. However, magazines and newspapers became a source of information for more students as grade levels increased, while fewer students saw their parents as a source of environmental information at the higher grade levels.

The findings of Alaimo and Doran (4) are supported by the results of Melton's (322) survey of 598 Philadelphia junior high school students which found that the media outscored all other possible sources of information, having been selected 32% of the time as the major source of environmental information. Volk (501), in an experimental study involving 83 eighth graders, found that the students in her control group, like the junior high students in the previous two studies, reported television as their number one source of information concerning environmental issues. On the other hand, the experimental group in her study, which received instruction with issue investigation modules, cited the school as their number one source of information concerning issues.

Fortner and Teates (100) in their examination of the experiences of 787 students in grade 10 related to marine knowledge and attitudes, also found that television was perceived as the major source for this type of information. Television specials, followed by movies, were reported by the students as having the greatest influence on their marine knowledge and attitudes. Magazines, regular school classes, books, newspapers, TV news, and several other items were all seen to have a lesser effect. Eyers (290), in a survey of 4,821 Australian 10th grade students' environmental knowledge and beliefs, found that these students had perceptions similar to the American students in regards to environmental information gathering. "Media and reading" were indicated by 45% of the students to be their greatest source of environmental information, followed by "general education at school" (36%), "discussion with others" (15%), and "special course at school" (4%).

The five studies that investigated self-reported sources of environmental information for adults were more diverse in their nature, and therefore a more difficult base from which to draw conclusions than were the studies that dealt with student populations. Several of these studies indicated that for adults, television is perceived as a major source of environmental information. Two of the studies of adult populations involved information about local issues and both of these indicated that interpersonal contact becomes an important source of environmental information at the local level.

Murch (187) in his 1970 survey of 205 residents of Durham, North Carolina, asked whether they could "recall reading or hearing about pollution or damage to the environment recently and if so, where?" Television received the highest response rate with 73%, followed by local newspaper 62%, magazines 37%, friends 21%, other sources 12%, don't recall 1%, and no answer 6%.

Zimmerman (262), in his survey of 363 Kansas sportsmen, looked at mass media sources of conservation education and the frequency with which each was used as a source of information. Categories of occasionally, often, and always were totalled and indicated that television (88.7%) was the most frequently used, followed by sporting magazines (83.0%), outdoor pages of newspapers (78.6%), radio programs (63.0%) and finally the conservation magazine (60.6%). Other media sources of information that few respondents indicated as sources included conservation and sporting books, requesting information or literature from conservation agencies, and regular attendance at conservation movies, lectures or slide shows. The specialized nature of the population surveyed in this study makes it difficult to generalize these results to other populations.

Sharma, Kivlin, and Fliegel (215), in their study of 225 residents of a northern Illinois community, investigated how residents felt about the reliability of various sources of information for local issues such as population. The respondents surveyed in this study were classified into "high interactors," people who discuss the pollution problem in informal groups, and their counterparts, the "low interactors." The majority of both groups identified the media as the most reliable source of information for this type of issue (48% of the "high interactors" and 65% of the "low interactors"). Media was followed in both groups by public meetings (33% and 29%) and friends and family (19% and 7%, respectively).

In another study involving awareness of a local issue, Stamm and Bowes (223) investigated the communication channels used in spreading awareness of a proposed Army Corps of Engineers flood control project. Mass media, i.e., newspapers, radio and television, (24.43%) and interpersonal communication (20.23%), were the two greatest sources of information, with only a small percentage of the respondents indicating the Corps of Engineers, government officials or formal groups as sources of information. Another 35.5% of the population indicated that they had not heard anything about the project.

Bailey (14) conducted interviews of 279 teenagers and adults from Madison, Wisconsin prior to and following Earth Day, 1971, to ascertain how information about the event was diffused. For both the pre and post samples, newspapers and interpersonal contacts were the most frequently cited sources of information.

In addition to investigating where people received their information about environmental issues, two of the studies also looked at the effect of information sources on knowledge levels. Eyers (290) and Fortner and Teates (100) both found that receiving information from the media had a positive effect on knowledge levels. Eyers (290) found that the "media" group in his previously mentioned study scored significantly higher in five of the 29 items on his knowledge test than students who identified "general education at school" as their primary source of environmental information. Fortner and Teates (100) found that television (r=.37) and frequency of reading National Geographic (r=.31) were positively correlated to scores on a test of marine knowledge in their previously discussed investigation.

Sharma et al. (215) investigated the relationship between several methods of environmental information gathering and a predisposition towards closing down a polluting industry. The researchers found no significant relationship between the amount of information gathered about local pollution from the newspaper and a willingness to close a polluting industry. However, discussing pollution problems with family and friends was associated (path coefficient = .36) with a predisposition to favor closing down the polluting industry.

Another two studies looked at variables that influence the source of information that different populations might use. Bowes and Stamm (223) found that face-to-face interpersonal contact was much more frequently cited as a source of information about a proposed Corps of Engineers flood control project by the rural population in the study (32%), than urban population (14%). Melton (322), found in his survey of 7th and 9th graders, that the low socioeconomic status 7th graders more than any other group of students reported the media as a major source of information.

Summary

Based on the findings of ten studies investigating self-reported sources of environmental information, the following generalizations may be drawn:

1. The media, in general, and television in particular are perceived by the public, both school children and adults, to be their major sources for environmental information.

2. Most adults perceive the media as a reliable source for environmental information.

3. School children may not see school as an important source of environmental information because of a lack of coverage of this information by schools.

4. The types of environmental information-gathering processes used by an individual may be influenced by demographic characteristics, (e.g. rural vs. urban).

5. Interpersonal contact is an important information source for persons when local issues are involved.

Media Coverage

Various aspects of the mass media, related to their coverage of environmental issues, was the topic investigated by nine of the studies abstracted in the RIEE report. This section discusses five studies which investigated coverage of environmental matters by the media, and trends in the amount of this coverage as measured by a content analysis method. Also, three of the studies in this section were surveys which measured the opinions, attitudes and self-reported policies of media personnel as they related to presenting environmental information to the public. An additional study reported in this section attempted to determine the type of environmental information presented to journalism students during their college careers.

One of the earliest studies attempting to measure trends in the amount and type of environmental information presented by the media, was Clausing's (63) investigation of selected issues of Field and Stream, Outdoor Life, and Sports Afield, for the years 1966-1968. Content analysis of the articles in these issues revealed no change in the amount or breadth of environmental information presented over the time period covered. Belak (25) examined the same magazines for the time period 1968-1970, and found that although the magazines centered the majority of their environmental information around fish and game issues, there was a trend for them to cover broader areas of environmental concern.

Bowman and Hanaford (440) analyzed eight mass circulation magazines to determine the frequency of the environmental items appearing in them for the years 1971-1975 and compared these results with the findings of a similar study covering the 1960's. Reader's Digest and Time were found to be the most frequent publishers of environmental items, with Time publishing more frequently during this study period than during the 1960's. Sports Illustrated, Better Homes and Gardens, and Playboy each published few articles. The study also found that while Harper's and National Geographic's rate of environmental publication increased during the 1970's, McCall's rate decreased. Overall, management of resources and water quality received the most coverage, with the majority of the former coming after the 1973 energy shortage.

Bavec, Broom and Schoenfeld (22) explored trends in the nature of the oil and forest industry advertisements found in four major magazines during the years 1958-1977. The authors found a dramatic increase in the number of advertisements with an environmental theme over the time period. While only about 20% of the oil industry ads and approximately 8% of the forest industry ads featured an environmental theme during the years 1958-1965, approximately 50% of both the oil and forest industry ads featured such a theme during the 1972-1977 time frame. In addition, the researchers found that the number of ads that encouraged product consumption decreased dramatically during the two time periods; from about 32% to about 9% for the oil industry ads and from nearly 72% to slightly over 4% for the oil industry ads.

Hungerford and Lemert (464) used content analysis to determine characteristics of the environmental news items found in each of Oregon's 20 general circulation daily newspapers for a constructed week during 1970. The authors concluded from their investigation that these items tended to be written by local staffs about non-local issues and places. Governmental sources were much more likely to have been used as a source for environmental news (58%) than industry and industrial sources (13.7%), miscellaneous other sources (11.9%), scientists (8.9%), and conservaticnist-environmentalists (7.4%). The analysis also revealed that only one in five of the articles contained any information about the environmental actions that could be taken to help solve the environmental problems reported. Excluding both advertising and letters to the editor from consideration, environmental items occupied 2.7% of the available space in these newspapers.

Two major surveys of media managers attitudes, opinions and self-reported policies towards environmental news reporting were included in the RIEE report. These two studies are Bowman's (32) 1977 survey of 90 editors of 138 of the nation's largest daily newspapers and Althoff, Greig, and Stuckey's (431) earlier survey of 104 media managers in Kansas. These studies taken together, along with references made in the Bowman article to a 1970 national survey of 56 newspapers by Maloney and Slovonsky and the results of the previously discussed analysis by Hungerford and Lemert of Oregon newspapers in 1970 begin to portray the status of environmental news reporting.

Bowman (32) and Althoff et al. (431) both found that the media personnel they surveyed were concerned about environmental issues. 91% of the broadcast media personnel and 78% of the newspaper personnel in the Althoff (431) survey thought "that pollution is a real problem." Nearly 90% of the respondents in Bowman's study were either "deeply concerned" (48.9%) or "somewhat concerned" (38.9%) about environmental issues. The editors in Bowman's (32) survey seemed to be more optimistic about environmental conditions than respondents in the Althoff (431) survey. The former found that (46.7%) of the editors in his survey believed that environmental problems had improved since 1970, while the latter found that the Kansas journalists in 1970 felt that the environment was deteriorating.

On the other hand, the surveys indicated that the amount of coverage given to environmental news has increased from 1970-1977. The editors in Maloney and Slovonsky's 1970 survey[1] reported that they ran approximately twelve environmentally related stories per month. Similar results were found in tht Kansas survey (431), where 55% of the daily newspapers reported running only 1-10 stories/month, while another 32% indicated carrying 11 or more stories per month. Bowman found in his 1977 survey that over half of his 90 respondents claimed to print at least 30 of these articles each month. Although the previous results suggest that environmental news had retained or increased its position of importance in the news over the years 1970-1977, both surveys found that the environment ranked a distant last place after politics, economy, education and crime in the amount of news coverage it received.

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[1] Maloney, John C., and Lynn Slovonsky, in Leslie L. Roos Jr. (ed.), The Politics of Ecosuicide, pp. 64-78. New York: Holt, Rinehart, and Winston, 1971.

Bowman's study seems to indicate that newspaper editors may have taken efforts to remediate the often reported scenario of the media focusing on non-local environmental issues while ignoring local ones. Fifty-seven of the 90 editors (63.3%) in Bowman's study felt that they published information on local pollution, while only a handful of the 56 editors in the Maloney and Slovonsky study indicated doing so. Editors in Bowman's survey, moreover, emphatically denied charges of focusing on non-local issues with 88.9% of the editors disagreeing with the statement that "environmental stories in your paper tend to emphasize pollution problems in other localities." Bowman feels that this trend to report local pollution levels may be attributed partly to the fact that more of this type of information may have been available in 1977 than in 1970.

Neither the Bowman or the Althoff et al. study found that media personnel had strong editorial policies for or against environmental protection. Most advocated a balanced case-by-case approach to these issues. However, 74% of the newspaper personnel in the Kansas study acknowledged that they would accept advertising from a known polluter, while 60% of the editors in Bowman's survey indicated the same. An overwhelming majority of the respondents to both surveys had editorial policies to encourage new industries to locate in their areas. There was uncertainty on the part of many of the respondents, however, on whether or not this would include the recruitment of polluting firms. The authors of both surveys came to the conclusion that the contradictory policies of newspapers would seem to dilute the effects of editorial attacks and news stories on pollution problems. Also, in contrast to the Hungerford and Lemert survey which found that "conservationist-environmentalists" were seldom used as sources for environmental news, Bowman found that 78.9% of the editors in his survey felt that environmental news releases, spokemen, and reports were a primary source of environmental information.

Schoenfeld (492), through a survey administered in May 1978, investigated what the "environmental writers" of the nations newspapers felt about the state of environmental news journalism. Those surveyed were asked to respond with an informal note. A number of observations were made by Schoenfeld, from the replies of 31 writers and insights from other sources of an additional 10. The environmental writers, Schoenfeld felt, seemed to dispute the idea that the amount of environmental news covered by newspapers was increasing; they saw the "newsworthiness" of environmentalism declining as it became more routine. However, this study also suggests that the "environmental news writer" is an established position on many dailies. In addition, the majority of these writers seem to have a strong ecological conscience and clearly see themselves as participants in a public policy-making process.

Information gathered by Griffin and Schoenfeld (456) from 171 undergraduate departments of journalism and mass communication in the U.S. provides evidence that most journalism students are exposed to some environmentally related information through their coursework. The authors conclude that one impact of the environmental era on journalism programs has been to define environmental issues as matters of public debate and policy, so they are presently commonly covered in public affairs reporting courses.

Summary

Based on information presented in the ten articles dealing with media coverage of environmental issues, the following generalizations can be drawn:

1. Environmental issues seem to have an established and continuing position in the media, as matters of public debate.

2. The amount of environmental information presented by the media seemed to increase over the time frames covered here. (1960-1977 magazines, 1970-1977 newspapers)

3. Although most media personnel espouse a personal concern about environmental problems, they were not considered as "newsworthy" as a number of other topics.

4. Few media managers took an editorial stance that was either pro or anti-environmental. (Over half of the newspaper editors surveyed, however, acknowledged that they would accept advertising from a known polluter).

5. Although television was reported as the number one source of environmental information in most of the studies surveyed in this investigation, only one study in this section looked at television and quality of environmental information.

6. Considering the magnitude of the topic of media coverage of environmental issues and the influence it seems to have on the public, very little research has been done in this area.

Public Belief Systems Concerning Environmental Issues

Many of the research articles identified from the RIEE report as investigating "Environmental Issue Awareness" focused on public beliefs about these issues. These articles examined several aspects of public belief systems and are best reviewed by classifying them into the following three categories: 1) Concern about Environmental Issues, 2) Public Beliefs about the Nature of Environmental Problems, 3) Public Beliefs and Perceptions about Solutions to Environmental Problems.

Concern About Environmental Issues

A number of the research articles collected in the RIEE report referred to a variable termed "environmental concern." Although the definition of this term seems to vary somewhat from one article to the next, for the purposes of this discussion the term will be defined as "a measure of interest and perceived involvement in environmental issues." Not every article reviewed here uses the term "environmental concern," but all try to ascertain the degree to which different populations are concerned with environmental issues.

Most of the researchers reporting the following data have identified a number of demographic variables and tried to relate them to levels of "environmental concern." In addition to the papers reporting the results of a single data base, one of the articles in this section is a synthesis of the results of 21 studies examining the variable "environmental concern." (499).

The data collected in these studies indicate that several demographic variables may be associated with varying levels of environmental concern, (especially educational level, age and political ideology), while other variables often hypothesized to be related to varying levels of environmental concern, may in fact not be (especially social class measures such as income).

Most of the studies that investigated environmental concern levels and age found an inverse relationship between the two (49, 51, 215, 442, 499). The results reported in research documents by Buttel and Flinn (49), Buttel and Flinn (51) and Buttel (442) all reflect the data collected in a 1974 survey of 548 adults from Wisconsin by the Wisconsin Research Laboratory. These studies all reported a negative relationship between age and measures of environmental concern. Buttel (442) reported total and direct effects of age on awareness of environmental problems at -.305 and -.271. For his other measure of environmental concern, support for environmental reform, total and direct effects were calculated at -.286 and -.196 respectively.

Sharma, Kivlin and Fliegel (215), in a study also included in the Van Liere and Dunlap (499) synthesis, found that the older people among the 225 residents of a northern Illinois community they surveyed tended to view population as less of a serious problem than young people (F ratio = 2.9; p = .08).

On the other hand, Young (261) in a telephone survey of 503 Illinois residents in May of 1977 found a positive relationship between age and approval of the wilderness issue (Beta=.14). This may indicate that support for environmental reform and awareness of environmental issues varies from issue to issue within specified cohorts.

The bulk of the evidence collected by Van Liere and Dunlap (499) in their study supports the hypothesis that age and environmental concern are inversely related. Most of the coefficients relating age and environmental concern ranged from -.2 to -.4 which suggested a moderate negative relationship. Although several of the studies they reviewed found little or no correlation between these variables, they concluded that "the preponderance of evidence must be viewed as supportive of the age hypothesis."

Another variable that was often hypothesized by researchers to be related to environmental concern levels was educational level. Buttel (48) examined data collected by the Wisconsin Survey Research Laboratory during the summers of 1968, 1970, and 1972 to determine if any relationships existed between levels of environmental concern and educational level. The data from these surveys all indicated that college graduates were much more likely to be concerned with environmental issues than other educational groups. Young (261) in his previously cited survey of variables related to approval of the wilderness issue, found years of education to be positively correlated to the dependent variable (Beta = .19).

Contrary to these findings, three research papers that examined the relationship between educational levels and concern levels using data collected in the previously mentioned 1974 statewide survey of Wisconsin residents, Buttel and Flinn (51), Buttel (275), and Buttel (442) found the relationship between educational levels and environmental concern to be quite meager. Total and direct effects of .060 and .069 were reported in the Buttel (442) 1979 report.

The research base collected in the Van Liere and Dunlap (499) synthesis report indicated that educational levels in most of the articles reported were positively associated with environmental concern levels to a moderate degree (r's ranging from .15 to .40). Other studies reported indicated little or no correlation between the two. The majority of the evidence collected by Van Liere and Dunlap (499), however, does seem to indicate a moderate relationship between educational levels and environmental concern levels.

Social class was often hypothesized to be related to concern levels with those of a higher status usually presumed to be more concerned than those of a lower status. This hypothesis is not supported by the results of the studies contained in this section.

Cutter (445) interviewed 940 adults from Chicago in a stratified random sample to investigate the relationship between several community characteristics and levels of environmental concern. Concern was measured by whether or not residents worried about pollution, considered it a problem, and were bothered by it. Counter to pre-survey expectations, the author found that low status Black communities had higher levels of environmental concern than the high status White communities. High concern levels were negatively associated with increasing family income levels, white collar jobs and owning a home, all indicators of increased social status.

Melton (322) likewise found in his study of 598 students in twelve Philadelphia junior high schools that high SES students were less concerned about environmental issues than low SES students.

Two additional studies found almost no relationship between the two variables. Buttel and Flinn (51) found the relationship among the three major indicators of social class, (education, income and occupation), and environmental concern to be quite meager. Similarly, Neiman and Loveridge (484) found no relationship between social background and attitudes towards protecting the environment.

Van Liere and Dunlap (499) found little support for the hypothesis that there is a positive relationship between increasing levels of social status and environmental concern. The researchers found "evidence for occupational prestige provides very weak support at best, while the overall evidence for income is highly ambiguous."

Several researchers have attempted to measure the relationship between levels of concern and political ideologies. Buttel (442) found a statistically significant correlation between one measure of environmental concern (support for environmental reform) and political liberalism. However, political liberalism was not significantly related to another measure of environmental concern, awareness of environmental problems.

The Van Liere and Dunlap (499) review found little evidence to support the contention that Democrats are more environmentally concerned than Republicans. However, they did find substantial support for the hypothesis that liberals are more environmentally concerned than conservatives.

Another variable thought to be related to environmental concern by many researchers was residency. Most of these studies compared the level of environmental concern of urban residents to the level expressed by rural residents. Although most researchers found that urban residents expressed slightly more environmental concern than rural residents, most of the evidence is inconclusive and some of it ambiguous.

Buttel (442) found that there was a substantial positive relationship between urban residency and one of his measures of environmental concern, awareness of environmental problems - total and direct effects of .351 and .345. A much weaker relationship was found between urban residency and his other measure of environmental concern, support for environmental reform - total and direct effects of .116 and .084.

The level of environmental concern expressed by residents in urban and rural areas was measured in another study by Buttel et al. (48), using data collected by the Wisconsin Survey Research Laboratory in the summers of 1968, 1970, and 1972. Place of residence included the following categories: urban, rural non-farm and rural farm. The rural non-farm sample expressed the greatest level of environmental concern overall, followed by the urban sample, with the rural farm sample expressing the lowest level of concern about environmental issues among the three groups. This study suggests that rural non-farm and rural farm populations are two distinct populations and should be dealt with as such when measuring beliefs towards environmental issues.

Van Liere and Dunlap (499) found that although many of the ten research articles they reviewed that examined the relationship between residence and environmental concern supported the hypothesis that urban residency is positively correlated with environmental concern levels, there were many contradictions to this pattern. They also found that the coefficients varied greatly in magnitude, both within and across studies. They suggest that the relationship between residence and environmental concern may depend on the indicator of environmental concern being measured.

Only one article reviewed for this section of the RIEE report investigated the effect of gender on environmental concern levels. Van Liere and Dunlap (499) included this variable in their review "to examine the degree to which a sex-environmental concern relationship might exist, even though ignored by most researchers." They found that the few results that have been reported on this relationship were conflicting and indicated weak relationships. Van Liere and Dunlap (499) conclude that the evidence suggests that gender is not substantially associated with environmental concern. They also caution that this conclusion should be viewed as tentative, since it is based on limited evidence.

Summary

Based on the findings of the studies investigating levels of environmental concern and how these vary, the following conclusions are drawn:

1. Higher educational levels seem to be, in most cases, associated with greater levels of environmental concern.

2. Age seems to be negatively associated with environmental concern.

3. The relationship between social class and environmental concern levels was minimal in the research articles reviewed. Two research articles indicated that people with a lower social status may in fact express more concern than their higher social status counterparts.

4. Political liberalism was found to be positively associated with environmental concern levels.

5. Although there was some evidence that urban residency was associated with greater levels of environmental concern, the evidence was ambiguous and weak.

6. Evidence collected so far indicates that there is little or no relationship between gender and level of environmental concern.

7. Determinations of environmental concern levels are affected by the method by which they are measured and by the issues or set of issues they are being associated with. Tighter controls of these factors are needed by future researchers in order to make valid conclusions about the effect of a number of variables on concern levels.

Public Beliefs About the Nature of Environmental Problems

Three studies surveyed respondents' perceptions of the most important environmental concerns. Horvat and Voelker (122) investigated 645 fifth and eighth grade students' perceptions of environmental problems. When presented with a list of six environmental problems, 40 percent of the students identified air pollution as the most important problem. This was followed in importance by water pollution identified by 28 percent of the students as most important. A lesser portion of the students specified the following problems as most important: chemical pollution (12%), overpopulation (12%), preservation (5%) and noise pollution (4%). The authors inferred that levels of affluence may determine what problem children see as important, in that students from upper-middle class families possibly reflect their parents' concern for overpopulation and wilderness preservation while children from lower SES families tend to have a greater concern for water pollution and noise pollution, which are more pressing problems in their immediate environment.

According to the findings from a descriptive study by Althoff, Greig and Stuckey (431) of media (radio, television and daily newspaper) managers in Kansas, water pollution was considered the most serious on a list of five environmental issues. This was followed by air pollution, natural resource conservation, and noise pollution in descending rank order.

Hungerford and Rubba's (463) research involving secondary school students (n=103), K-12 science teachers (n=193), environmental newsletter readers (n=90) and environmental education trainees (n=73) revealed that these groups differed in their perceptions of what were the most important environmental issues. When given a list of eighteen environmental issues, the newsletter readers and the environmental education trainess, both of which the authors assumed to be more knowledgeable about the environment and related issues, denoted land use management, overpopulation and energy consumption as the three most important issues. The secondary students and science teachers (whom the authors assumed to be less environmentally knowledgeable groups) ranked land use management fifteenth and fifth respectively and overpopulation tenth and third. Energy consumption was the only issue that all four groups ranked as one of the top three most important environmental issues.

The authors stated that teachers should be made aware of the perceptions of environmentally-knowledgeable groups and the reasons for those perceptions. Also, since issue selection of the less environmentally knowledgeable groups seemed to reflect the influences of the popular media, the researchers suggested that educational institutions may have to counteract such influences in order to focus students on issues which are more important on a global scale.

Six studies surveyed respondents' views concerning the severity of environmental problems. Sofranko and Bridgeland (219) surveyed 124 Illinois mayors regarding the severity of environmental problems. In general, the mayors felt that environmental problems were not serious. They felt that environmental concern was primarily due to heightened environmental aspirations and to a small vocal segment of the population advocating a cleaner environment.

Opposite findings were disclosed by Bowman's (32) study in which almost 90 percent of 138 American daily newspaper editors agreed with the statement that "pollution is one of the most serious problems facing our nation today." Approximately two-thirds of the editors rejected the statement that "we should be willing to accept more air and water pollution in order to insure more plentiful supplies of energy." In contrast to the mayors' perception of a "small vocal segment" of the population being environmental advocates, only 11 percent of the newspaper editors (who expressed favorable attitudes toward the environmental movement) were members of a conservation group.

A descriptive study by Strand (495) of 1003 adults indicated that concern for the energy situation was related to education level but not to age, political party identification or income. According to his findings, educated people are more likely to perceive the energy situation as serious.

Simon's (217) descriptive study of 170 persons in Illinois revealed that respondents had a high concern for air and water pollution. Of those contacted by telephone, 95% thought air pollution was a problem, 91% thought water pollution was a problem and 67% thought the world's population was growing too fast. Although respondents had a great deal of concern for air and water pollution, only 50 percent approved of the high priority President Nixon placed on those problems, indicating that other issues were more important to the subjects.

In two studies that assessed respondents' views regarding the seriousness of environmental problems, subjects perceived them to be more serious for others than for themselves. Results from Rickson's (201) descriptive study of 485 high school seniors indicated that 76% of the students thought pollution was a very important issue to people in general but only 53% felt it was a very important issue to them. These students ranked pollution as the third most important issue affecting society, but the sixth most important issue affecting themselves.

Similarly, in a study of 205 adults by Murch (187), 74% of the respondents perceived pollution to be a serious national problem but only 13% saw it as a serious local problem. Murch stated that home owners and those who were satisfied residents perceived less seriousness resulting from pollution than did renters and dissatisfied residents. The inclination to perceive pollution as a serious problem increased as the reference point moved away from their community. The author attributed this to the tendency of the media to focus on national and global problems and to a psychological factor where people are reluctant to acknowledge serious defects in their own surroundings.

Although environmental issues are perceived as serious, there tends to be an unwillingness among people to make many sacrifices to mitigate the environmental problems. In a descriptive study by Silvernail (216) of 181 preservice and inservice teachers, 89% of the teachers believed that Americans should be encouraged to purchase consumer goods made of recyclable materials, 88% believed the government should promote economic growth policies which will conserve natural resources and protect the environment and 82% believed that U.S. industries should produce goods designed to conserve energy sources. However, only 38% of the subjects believed Americans have a moral obligation to share their wealth with the less fortunate people of the world and 19% believed that the U.S. should promote the welfare of all the world's people even though it may be against American national interests.

In a descriptive study by Richmond and Baumgart (491) of 11,008 fifth year high school students in England, the authors found support for environmental problem resolutions to wane as required personal sacrifices increased. Approximately 80% of the students supported preserving the environment, avoiding pollution and restoring damaged areas. However, only 65% supported environmental controls through incentives and regulations if it caused some inconvenience and less than 50% supported preservation of the environment if it caused conflicts between other potential economic, social or personal benefits.

Rickson (201), who surveyed 485 high school seniors, concluded that the reactions of respondents to environmental pollution and overpopulation were not exclusively determined by self-interest. According to Rickson (201), self-interest (choosing alternatives that are least costly to that person) does not shape the perception of U.S. seniors regarding facts and policy recommendations relative to pollution and the population explosion. His interpretations of the data suggest that there are variables of equal importance such as concern for individual freedom and perhaps alienation from some aspects of the industrial system. Because only high school seniors were involved in this study, the author admits that the generalizability of the findings is limited. Adults, who must have jobs to support their families and have other concerns, might respond differently. However, Rickson (201) submits that the adult responses would be different from high school seniors in degree but not in kind.

The perceived causes of environmental problems were addressed in five studies. In a study by Alaimo (264), 615 students grades 7-12 generally perceived economic reasons as the primary cause of environmental problems.

Cohen's (65) descriptive study of 454 high school students found differences between high environmental content (High EC) students' and low environmental content (Low EC) students' views toward pollution problems. A large majority of the High EC group agreed with the statements that "American beliefs and values have been a basic cause of our present pollution problems" and that "Our environmental problems will not be solved by existing American political and economic institutions." The Low EC group's responses were more evenly distributed. The high information subgroup appears most inclined to select a polarized position and less inclined to select a "no comment" position than the low information subgroup. The subjects in this study, particularly the High EC students, blamed "citizens" for pollution but were reluctant to consider themselves as such citizens.

Similar findings were disclosed in Bowman's (33) survey of 325 university freshmen. He found that students deeply committed to environmental quality believed that fundamental cultural values have been a basic cause of ecological problems and that present public and private institutions are unlikely to bring about that reform. In another survey by Bowman (32) of 138 American daily newspaper editors, over 60% agreed with the statement that "American beliefs and values have been a basic cause of our environmental problems."

Murch (187) also found that human factors were perceived to be the cause of environmental problems. In his study of 205 adults, it was found that 40% of the subjects felt that environmental problems were caused by human greed, compared to only 8% who blamed machines.

Simon's (217) study, however, revealed opposite findings. Of the 170 adults sampled, 65% blamed pollution on cars and industry, 41% blamed industrial waste for water pollution and 20% blamed municipal sewage and dumping policies. The adults in this study did not consider "people" to be the prime source of pollution.

Even though people felt that environmental problems were serious and that human values and beliefs were responsible for these problems, the results of several studies indicated that many individuals did not feel they could do much to help solve environmental problems. In a descriptive study by Mitchell (182), a high percentage of the 400 adults sampled did not believe that the average person knew enough about water management to get involved, less than 2% had personally become involved in decision making. The author stated that it is often difficult to predict behavior from possessed attitudes.

Horvat and Voelker (122) found that 45% of the 645 fifth and eighth grade students they surveyed felt people in their community could help most in solving environmental problems but 21% denoted that "me and my friends" were the least able to help solve environmental problems. Similarly, 70% of the 454 high school students surveyed by Cohen (65) agreed with the statement "I should make other people aware of environmental problems" but only 45% agreed with the statement "I can affect the decisions made in my city."

Summary

Based on the results of the studies reviewed in this section, it appears that the following generalizations can be drawn:

1. Perceptions of what environmental issues are most important vary with age and amount of knowledge possessed about the environment and environmental issues.

2. Most people believe that environmental problems are serious issues.
3. Support for environmental problem resolutions tend to wane as required personal sacrifices increase.

4. Many individuals believe that fundamental American cultural values and beliefs are the cause of environmental problems.

5. A large number of subjects did not believe they could do much to help solve environmental problems.

Public Beliefs and Perceptions About Solutions to Environmental Problems

Twenty-four of the papers reviewed for this report examined the public's beliefs about the solutions to environmental problems. Some of this research addressed this question exclusively while others examined this question along with other research questions. Some of the findings of the latter variety have also been reported in a previous section of this chapter. The studies included in this section investigated (1) the public's beliefs about the solutions to environmental problems, (2) how these beliefs are affected by several situational variables, and (3) the public's beliefs about the role of the individual in the environmental problem solving process.

Problem-Solving Strategies

Five of the studies looked at a variety of situational variables and their effects on the selection of environmental problem solving strategies. The studies in this section distinguish between attitudes towards conservation issues that Grunig and Stamm (457, 494) refer to as (1) reversal of trend - the trend towards using the scarce resource should be reversed (e.g. conservation measures emphasized), and (2) functional substitution - using a functional substitute to replace the resource when it becomes scarce (e.g. development of new technologies).

Stamm and Grunig (494, 457) conducted two separate studies that presented respondents with several environmental problems, and then asked them to rate, on a scale of 0-10, two solutions for each problem that represented reversal of trend and functional substitution orientations. For each problem, subjects were also asked to respond to a number of questions that measured situational variables defined by Grunig. Responses to these questions were subsequently analyzed as to their effect on the cognitive strategies respondents chose.

The first of the reversal of trend vs. functional substitution studies by Stamm and Grunig (494) was conducted in 231 telephone interviews to residents of several metropolitan areas. The authors concluded from this study that (1) support for reversal of trend and functional substitution solutions varied across the issues; (2) support for reversal of trends was stronger than support for functional substitutes; (3) although correlations between the situational variables measured and solution orientations were small, the correlations were strong enough to show that reversal of trends generally is a referent criterion i.e., that many people apply it across situations and that functional substitutes generally are developed in the course of resolving a specific issue, and (4) involvement in a situation makes a person more likely to support both types of solutions to problems, particularly if applying reversal of trends solutions means giving up something important. The authors point out that this concurs with other studies which show that support of environmental measures abates when a person's self-interest may be affected.

The second of the "reversal of trend vs. functional substitution" studies by Stamm and Grunig (457) involved a purposive sample of 225 residents of nine rural communities in three states. The data from this study supported the previous study's findings that support for each of the two types of solutions varied across the issues and that involvement in a situation led respondents to choose both types of solutions (even when these solutions weren't compatible). The authors feel that these studies taken together indicated that people who are concerned about environmental problems apply the reversal of trends solution until they encounter a problem that involves them, at which time they also advocate functional substitution solutions.

A study by Stamm and Bowes (224) used scores from an instrument that measured "reversal of trends" and "functional substitution" orientations as independent variables and looked at their effect on (1) support for the Army Corps of Engineers, (2) knowledge of a proposed Corps project and (3) perceived agreement with the Corps. The data for this study were collected from questionnaires completed by 174 residents of Grafton and Park River, North Dakota. Persons scoring high on "reversal of trends" had less support for the Corps than those with low scores; those scoring high on "functional substitution" had greater support for the Corps than low scores, with the latter correlation being stronger. Those scoring moderately on "reversal of trends" named more project disadvantages than those scoring either high or low; those scoring high on "functional substitution" named more project benefits than those scoring low. As persons scored higher on "reversal of trends," the number of benefits perceived in common decreased. This trend reversed on the "functional substitution" scores; more benefits were perceived in common as scores increased.

Strand (495) and Moore (185) looked at several other variables and the effect they might have on attitudes towards reversal of trend and functional substitution approaches to solving environmental problems. Strand (495) used telephone interviews of 1003 male and female California adults in his study of energy policy preferences and their relationship to: age, income, education, perceived seriousness of energy problems, and political party identification. Correlations between energy policy preferences and the independent variables revealed that perceived seriousness of the problem, age and party identification all helped to predict energy policy preferences. Those who perceive the problem as serious, Democrats and the young were more likely to support policies aimed at conservation (such as tax credits for insulation and solar conversion) than Republicans and the old. They were less likely to prefer policies aimed at increasing exploitation of traditional energy resources. Income and education, on the other hand, tended not to be correlated with preferences on specific energy policies.

Similar to Strand's (495) finding that education did not help predict which of the two solution orientations people would choose, Moore (185) in her survey of an unspecified number of League of Women Voters members found no relationship between scores on a test of ecological comprehension and the responses to an instrument that measured subjects attitudes towards reversing current trends in environmental management.

Legislative and Technological Problem-Solving Techniques

A number of studies abstracted in the RIEE report investigated the specific problem-solving techniques people believed should be used to solve environmental problems. Most of these studies found that legislation and technological advancements were the most often advocated problem-solving techniques. The following discussion focuses on the fourteen studies which investigated people's beliefs about these two methods of dealing with environmental problems.

Many studies reviewed indicated that government regulations are believed by a majority of the public to be an effective and desirable means of dealing with environmental problems. Although an overall general support for environmental regulatory legislation is evident in these studies, some of the studies indicate that when these policies move from the realm of abstract regulations to practices that will directly affect them, support dwindles considerably.

Rickson's (201) survey of 485 Minnesota high school seniors revealed that a majority of the subjects agreed that pollution and population growth are problems and that steps should be taken to alleviate these problems. When presented with solutions to these problems in the form of government controls, the majority of the students supported the measures in the case of the "pollution problem/the automobile." Seventy-one percent of the students agreed with the statement that all car owners should be forced to modify their engines to reduce pollution. In the case of the "population problem," however, only 29% of the students agreed with the statement that the number of children per family should be limited by the government.

Cohen's study (65) of 454 high school students in seven schools also found considerable support for government regulations to control pollution problems. Sixty-two percent of the sample disagreed or strongly disagreed with the statement that there are enough anti-pollution laws to control pollution.

"Enforcement of existing legislation" was the unanimous choice of the most effective "short-term solution" for environmental problems in Foerstel's (291) survey of 714 high school seniors, their parents, some of their teachers and members of the Sierra Club and National Audubon Society. This finding seems to indicate that the respondents felt that if environmental regulatory laws presently in effect were followed, environmental quality would be improved.

Two studies of high school students in other countries, Australia and England, also reported a great deal of support for governmental controls as a solution of environmental problems. In Eyers' (290) study of 4,821 Grade 10 students in Australia, 50.2% of the students agreed that "strong government anti-pollution laws are necessary." However, 21.9% disagreed with that statement. Indicating even more acceptance for government regulations was the fact that 58.9% of the subjects agreed that "controls designed to protect the environment should be placed on individuals even if things will cost them more." Only 10.2% of the sample disagreed with this view. It was stated that in comparing this study with a similar one done in the United States, Australian students were inclined to indicate that they would suffer more government controls than their U.S. counterparts.

Richmond and Baumgart's (491) study of 11,008 fifth-year secondary students in England reported results similar to the Australian study. Fifty-nine percent of the students agreed that "controls should be placed on industry to protect the environment from pollution, even if it means things will cost them more." However, less than 50% supported items that suggested conflicts between preservation of the environment and other potential benefits such as economic, social and personal ones.

Illinois mayors expressed a strong belief in government regulations as the most effective strategy for protecting the environment in Safranko and Bridgeland's (219) survey of 124 mayors of cities in the 10,000 to 50,000 population range. "Prohibiting certain detrimental practices by Law" was deemed the most effective strategy for dealing with environmental problems by 36.9% of the respondents, followed by "taxing violators in order to make it unprofitable to pollute" (35.3%), "increasing government expenditures to improve and protect the environment" (19.1%), and "appealing to the conscience of business and public" (8.7%).

Educational levels, environmental awareness, and place of residence were variables found to be related to favorability of environmental regulatory legislation by other researchers. Buttel (48) found in his 1968 survey of 573 Wisconsin residents that college graduates were much more likely (34%) than other educational groups to feel that environmental problems were worthy of government control. Geisler's (452) study of the acceptance of land use policy indicates that certain variables may be associated with specific types of controls, such as zoning laws for land use. Geisler found in this study of 1,423 non-institutionalized individuals residing in Northwest Wisconsin that environmental awareness was the number one predictor for the acceptance of land use policies. Education was consistently positively related to the approval of land use regulations and urbanites from the region were much more likely to accept the stated land use policies than rural open country residents. Some of the studies examining support for environmental legislation indicated that while people may generally support these types of restrictions, this support may diminish when they are given concrete examples of restrictions that will personally effect them.

Neiman and Loveridge (484) distinguished between what they labelled "general support" and "specific support" for environmental legislation. The relationship between these two types of support was measured by the researchers in a mailed questionnaire that garnered 459 responses from Riverside, California. Statements which advocated governmental controls for environmental protection measured "general support" and were found to be approved by the majority of the respondents irrespective of their educational backgrounds and income levels. "Specific support" was measured by whether or not the respondents had supported Measure B, a ballot measure that would have rezoned large portions of the city's remaining agricultural and undeveloped land for agricultural use only. Many of the respondents who had previously stated their "general support" for environmental restrictions did not indicate that they had shown "specific support" by endorsing this measure. Family income and educational levels were found to be "significantly related to this study's measure of 'specific support.'" Support for Measure B was greater as family incomes and educational levels increased, the former being a much stronger relationship than the latter. The author stated as a caution that there was a heavy campaign against the measure aimed primarily at lower income families.

The results of the Donohue et al. (79) study of four communities and their attitudinal responses to selected issues also reflected the phenomenon of support for environmental restrictions except when the population being sampled would be directly affected by such regulations. It was found that only 22% of the 102 randomly selected residents of Ely, Minnesota interviewed in 1972 agreed that "The Boundary Waters Canoe Area is one area of natural beauty that should never be opened for mining even in a national emergency." Three other communitites, not directly affected by the restriction, were surveyed with the following results: 41% supported the statement in Silver Bay, 64% in Grand Rapids and 65% in Duluth.

Beliefs about technological advancements as solutions to environmental problems were investigated by five of the studies reviewed here. These studies indicated that although there seems to be a widespread belief in technological answers to environmental problems, this belief may diminish at higher educational levels.

Technology was a favorite problem-solver, especially for water and air pollution problems, of the 435 5th - 8th grade students in Voelker and Horvat's (249) study of children's solutions to selected environmental problems. Technological responses ranged from 15.2% to 29.2% of the responses for four of the environmental problems posed.

Melton (322) found in a survey of 598 students from twelve Philadelphia junior high schools that students at varying grade levels expressed differing views towards environmental problem-solving. While 7th grade students felt that environmental problems facing us would best be solved by personal changes in behavior and scientific and technological advancements, 9th grade students expressed their beliefs that solutions to environmental problems were of the political and economic nature.

Donohue et al. (79) detected a widespread belief in technology as an environmental problem-solver among the adults surveyed in their study of knowledge about and attitudes towards environmental issues. Agreement with the statement that "technology got us into the pollution crisis, and technology can get us out" ranged from 65% to 87% in their initial survey in 1970 and from 58% to 77% in a follow-up survey done in 1972. In contrast to the results of the previous study, only 43% of the 325 freshmen surveyed at the University of Wyoming by Bowman (33) believed that the ecological crisis can be solved by the application of technology.

Silvernail (216) found similar results in a study of 225 preservice and inservice teachers enrolled in undergraduate and Master's levels education courses at universities in Georgia, Iowa and Maine. 64% of the teachers believed that technological breakthroughs will not solve many of our social and economic problems. A clear majority did not believe that technologies should be developed regardless of their potential side effects, environmental problems, and natural resource costs. Although 48% of the teachers believed that industrial production and expansion rates are true indicators of progress, 63% did not believe that this progress is worth all the problems it might create.

Role of the Public in the Problem-Solving Process

There are strong indications from a number of the studies reviewed for this report that although children and adults alike feel that the individual can have an important role in the resolution of environmental problems, they have little knowledge of what this role might be. Following is a review of six of the studies which looked at the role of the individual in solving environmental problems.

Mitchell's (182) descriptive study of 400 rural and urban residents and 23 professional water managers in Waterloo County, Ontario, explored the perceived role of the public in the environmental decision-making process. Interestingly, the professional water managers had a much higher opinion of the contributions the public could make to the decision-making process than did the residents themselves. Among other statements, 81% of the public sampled agreed or strongly agreed that the "average person does not know enough to make useful suggestions." In contrast only 49% of the professionals agreed or strongly agreed with this statement. The study also found that both the public and professional samples felt that the average person has values and opinions that should be considered by the experts. Over 50% of the public sampled felt that the individual has a chance to influence decisions, while over 70% felt that the individual has the chance to become involved in groups that make decisions. Yet, when asked if they had become personally involved in local water issues, none of the urban population replied positively and only 4% of the urban-rural sample and 2% of the rural sample gave positive responses.

Murch's (187) survey of 205 residents of North Carolina provides a graphic example of the public wanting to do something to solve environmental problems, but not knowing what it is they should do. Although 73% of Murch's sample felt that environmental problems could be significantly reduced, 50% of the sample couldn't name a specific solution possibility. Forty percent of the sample said they personally could do something to help stop pollution, yet 44% couldn't decide what they might be able to do or skipped the question entirely. The author stated that even those who believed that they could do something as individuals often didn't have a clear idea of what that might be. Those who did suggest a course of action most often limited it to changing personal or familar behavior.

Children voiced similar opinions to the adults in the previously discussed studies in regard to their ability to help solve environmental problems (4, 65, 80, 122). Horvat and Voelker (122) found in a survey of 645 5th and 8th graders from four southern Wisconsin communities that students most often cited "people who live around here," when asked who could help the most in solving environmental problems. However, responses by the students on who could help the least included "me and my friends" (21%), the Mayor (20.8%) and the President (22.2%). The students did not seem to include themselves as "people who live around here" in regards to environmental problem-solving.

Cohen's (65) study of the 454 high school students found that 70% of the total sample agreed or strongly agreed with the statement that "I should make other people aware of environmental problems." Yet only 42% agreed or strongly agreed that "I can affect the decisions in my city." A majority of the students (63%), however, expressed a belief that they could do something to help solve problems by disagreeing with the statement that "there is little I should do to solve our problems until I become an adult." The junior high school students studied by Doran (80) commonly responded to questions about possible environmental actions with statements such as: "We as individual students can't do much," "We're too young," and "No one will."

Alaimo and Doran (4) found that the 615 7th through 12th graders they surveyed were optimistic about the chances of solving environmental problems, rating the chances between "good" and "excellent." On the other hand, their survey also indicated that the students felt like they only had a "little" knowledge about environmental problems. This seems to indicate that although students generally believed that environmental problems would be solved, they did not see themselves as part of the solution.

Summary

Based on the findings of the 24 studies reviewed in this section, the following conclusions are drawn:

1. Policy preference for specific environmental problems seems to depend on a number of situational variables, making it difficult to predict inferences for a specific issue and population.
2. Government regulations are believed by many to be the most effective and desirable way of solving environmental problems. However, this type of support may not be as great when the regulations will directly effect the population being polled.
3. There is a belief among a segment of the population that technology will solve environmental problems, although this belief seems to decrease at higher educational levels.
4. Children and adults alike felt that the individual had a role in the environmental problem-solving process, yet could not express what they could do to work towards their solutions.

Teaching About Environmental Issues: Treatment Effects

Fourteen studies focused on instructional strategies dealing with awareness of environmental issues. These studies were divided into two major categories: 1) instruction occuring in a traditional classroom setting and 2) instruction occurring in an outdoor setting.

Traditional Classroom Setting

In the traditional classroom setting, research examined the effectiveness of curricula and methods for presenting knowledge of environmental issues using approaches such as an interdisciplinary model, simulations and games. Discussion of specific studies follows:

Experimental research conducted by Bryant and Hungerford (40) evaluated a kindergarten unit which focused on understanding the term "environment," associated pollution problems and their remediation. The results indicated that kindergarten children can form concepts concerning environmental issues and citizenship responsibility with respect to those issues. Not only were these children able to identify actions which they themselves could take, but many of the children were able to identify actions which adults could take. According to the authors, environmental education at the kindergarten level can result in some fairly sophisticated conceptual behavior on the part of the students involved.

The effects of an environmental unit on upper elementary students' concepts and knowledge about woodlands and associated environmental problems was studied by Gross and Pizzini (109). The unit was presented for two months prior to a field trip to a preserve. Seventy fifth grade students were randomly selected from a population of 295 for pretesting. The remaining 225 fifth grade students received the posttest along with 85 sixth grade students who had received the treatment one year previously. The authors stated that the treatment did result in a more positive student orientation regarding the use and abuse of wilderness. However, history and maturation effects were not controlled. A change in sensory and affective awareness of a natural community resulting from the one-day field trip was also noted. To maximize the effects of the limited time spent in the field, the authors recommended classroom instructional activities to facilitate concept formation prior to a field experience.

The effectiveness of Project ECO (Environmental Curriculum Opportunity) was researched by DeLuca, Kiser and Frazer (75). A total of 75 males and 75 females from each grade level (10-12) and 100 males and 100 females from each grade level (4-9) were randomly selected by gender and grade. A nearby school served as a control group. Initial differences that might have existed between the two communities were not assessed. Environmental knowledge and attitude tests were given at the elementary (fourth - sixth), junior high (seventh - ninth) and high school (tenth - twelfth) grade levels following instruction. Significant differences between the treatment groups in favor of Project ECO were found.

Crater and Mears (444) researched the impact an energy unit had on the knowledge and attitudes of eighth graders toward energy problems. In their study, the treatment groups (n=88) received an interdisciplinary energy activity packet developed by the National Science Teachers Association and the control group received the regular earth science course. Following completion of the unit, the control and treatment groups were assessed on their knowledge of and attitudes toward energy problems. The treatment group's attitude toward energy problems was at a higher percentage for each item on the instrument than was the control group. The authors concluded that the treatment group was more conservation-minded and aware of limited energy sources than the control group.

The effects of utilizing an interdisciplinary approach versus a traditional approach for examining environmental problems were addressed by Hepburn (114). Her findings revealed differences in posttest scores between science/social studies modules of instruction involving ninth grade (n=83) and slower tenth grade (n=106) students. Comparisons were made at each grade level across four treatments, i.e., a science module, a social studies module, an interdisciplinary module and a control treatment. Results indicated the interdisciplinary treatment groups attained the highest mean value.

The effectiveness of a problem-solving model in aiding participants in understanding and solving environmental problems was examined by Andren

(265), who used community college students as the sample. The problem-solving model consisted of 21 questions grouped into six areas of problem identification, historical context and proposing and testing solutions. An analysis of the contents of the students' investigative reports indicated that the experimental group discussed economics, law, transportation and population issues to a significantly greater extent than did the control group. It was concluded that this model was useful in systematically focusing students' attention to some of the necessary components of environmental problem-solving.

In a descriptive study by Supreka and Harms (421), two methods of presenting environmental education were compared to determine their effects on students' knowledge and attitudes toward energy and environmental issues. Eight teachers used an inquiry (non-values oriented) approach and eight teachers used a values-oriented approach to teach a six-week environmental education unit to over 600 high school students. Both treatments were found to produce significant cognitive gains compared to the control classes. The authors submitted that there was no difference in students' gains in knowledge between the two approaches and only a slight difference in attitudes toward environmental issues.

Two studies examined the effectiveness of simulation games over alternative teaching strategies. Botinelli (274) found in his research involving 720 high school students that the group receiving three days of traditional lecture without discussion fared significantly better on immediate cognitive and affective assessments ($p<.10$) than the three groups which each participated in a different environmental simulation game. No significant cognitive retention differences were revealed between the simulation groups. The author concluded that although environmental simulation games may not be as effective in teaching environmental concepts or in forming immediate positive attitudes as the traditional lecture-discussion method, they may act as a foundation from which more positive environmental attitudes can evolve and be retained for longer periods of time.

Bazan's (23) evaluation of four simulation games addressed two problems associated with environmental simulation games: a) limited participation and b) lack of economic relationships. In the four simulation games developed by the author, ecological and economic systems were modeled and up to 40 players could participate. The games simulated the behaviors, problems and conditions of producers, consumers, farmers, agriculture policy makers and the actors of a complex economic system. The participants became cognizant that the human socioeconomic system was problem-laden and without quick and easy solutions. The games were reported to be the most popular part of the course but their effectiveness over alternative strategies was not tested formally.

Outdoor Settings

Studies that examined the effectiveness of instruction utilizing an outdoor setting were divided into two categories. The first included outdoor instruction in conjunction with traditional classroom teaching. The second encompassed studies of environmental programs occurring exclusively in resident outdoor (non-formal) settings.

King (309) studied the effectiveness of four presentations involving the same energy production and use objectives. Using large n sizes of eighth and ninth grade classes, intact groups were randomly assigned to one of five treatments: 1) a field trip following classroom instruction, 2) classroom instruction following the field trip, 3) classroom instruction only, 4) field trip instruction only, 5) no energy instruction (control group).

His findings indicated that eighth grade groups receiving energy instruction scored significantly higher ($p<.05$) on the "Energy Knowledge" posttest than the control students. Significant differences were also noted in favor of eighth and ninth grade groups receiving both field trip and classroom instruction compared to those receiving only field trip or classroom instruction.

Research conducted by Peters (193) supports the findings of King (309). In Peters' study involving a group of seventh through ninth graders (n=128), the effects of urban field trips were examined. The results indicated that students receiving field trip preplanning and follow-up activities perceived a greater bond between classroom and community activities than students not receiving such instruction. Most of the students reported that the field trips aided classroom instruction and their understanding of the community character. The author concluded that field trips aid with perceptions of the community, enhance in-class learning, stimulate student participation in classroom discussions and activities, and help show relationships between education and the world of work.

Case's (277) study to determine the effect of an 8-week environmental education curriculum integrated in the regular school curricula revealed opposite findings, however. In his study, sixth grade students (n=93) of a Seventh-Day Adventist School were randomly selected and assigned to three groups. Group A was treated with the integrated curriculum for 5 weeks, one week of a resident field experience and an additional two weeks of integrated curriculum. Group B as treated with only the integrated curriculum for eight weeks and Group C acted as a control receiving no environmental curriculum activities. The Case Environmental Knowledge Test was constructed to measure environmental knowledge. On the knowledge test, significant differences were found between groups A and B in favor of the B group and between groups B and C also in favor of the B group. No significant differences were found between groups A and C. Interestingly, the outdoor experience did not seem to enhance students' knowledge.

Studies that examined the effects of outdoor environmental programs found significant changes in campers' knowledge toward environmental issues. Chitwood (279) found changes in environmental knowledge resulting from a camping experience. In his study, the effect of an 8-week session at a Youth Conservation Camp (YCC) on 58 enrollees was measured to determine the relationships, if any, among environmental knowledge, locus of control and environmental attitudes. Pre and posttests were administered to detect if there was a change in those variables. Statistical tests indicated that there were significant changes in a positive direction at the end of the eight week session in environmental knowledge and environmental attitudes but not in locus of control.

Research by Davis, Doran and Farr (72) supports the findings of Chitwood (279). In their study, 14,796 YCC campers were sampled from 194 camps to assess the participants' environmental awareness before and after their camp experience. Each camper completed a questionnaire of 40-50 questions either before camp (n=7,635) or at the conclusion of the experience (n=7,161). Of the eleven domains of goals developed, six knowledge domains showed significant pre to post gains, as did the attitude domain. Reliability of the tests and homogeneity of the domains were estimated.

Summary

Based on the results of the studies reviewed in this section (albeit some contradict each other), it appears that the following conclusions can be drawn:

1. Traditional classroom instruction can increase students' environmental knowledge.

2. An interdisciplinary approach for examining environmental problems seems to be more effective than a traditional approach.

3. Simulation games tend to be enjoyed by the participants but may not be as effective in teaching environmental concepts or in forming positive attitudes as traditional approaches.

4. A combination of classroom instruction and field trips may be a very effective means of increasing students' knowledge of environmental issues.

5. Field trips appear to have the most impact on student learning when occurring prior to classroom instruction.

6. Resident outdoor environmental learning activities can increase students' knowledge of environmental issues.

Discussion

The studies presented in this synthesis provide much information concerning research on environmental issue awareness. Yet, many uncertainties linger and several important questions remain unanswered. As with most research, the more that is discovered, the more the questions that arise. This is also true in this synthesis report.

Knowledge About Environmental Issues

In the research that examined how factual knowledge of environmental issues affected an individual's position on that issue, a positive relationship was found (i.e. more informed people tended to manifest a pro-environment position). The strength of this relationship, however, has not been broadly examined. More extensive studies involving a variety of age groups and other demographic backgrounds are needed to determine how strongly factual knowledge about environmental issues influences people's position on these issues.

There is some evidence that factual knowledge about environmental issues may not foster a more positive environmental position if personal sacrifice is required. It remains unclear as to what impact factual knowledge concerning an environmental issue may have on an individual if resolutions to that issue conflict with personal beliefs or self-interest. More studies need to be conducted in situations where the subjects are inconvenienced by the problem resolution to determine what influence factual knowledge has on pre-environmental positions. Descriptive studies which examine the characteristics of those individuals whose support does not wane when personal sacrifice is required are also needed. Experimental studies involving individuals directly inconvenienced by an environmental problem resolution using intervention treatments that 1) increase knowledge about the issues, 2) attend to the affective domain and 3) increase action skill competencies could also provide valuable information to guide future environmental education strategies.

The research abstracted by RIEE that examined the relationships between knowledge about environmental issues and variables such as residency (urban vs. rural), gender, age, income, level of education, SES, race and proximity to environmental problems is very sparse. None of these variables were examined with respect to knowledge about environmental issues in more than six studies abstracted by RIEE and many were only assessed in as few as two. More research is needed to verify the findings of existing research, to determine the degree of homogeneity existing throughout the general population, and to determine what factors are responsible for those relationships.

Sources of Environmental Information

The findings of this report that indicate that television is the major source of environmental information for both children and adults presents a challenge to educators to increase and upgrade the environmental information presented in classrooms. Several studies show that when environmental topics are discussed in the classroom, students begin to acknowledge the schools as an important source for environmental information. Students also need to be taught how to use the information they are presented with by the media. Recognizing that the media will be a major source of environmental information throughout students' lifetimes, materials presented by the media might be discussed and analyzed in the classroom to help students develop skills that will make them discerning consumers of such information. Bringing in selected media presentations might enhance students' learning, since two studies indicated that students receiving information about environmental issues from media sources had higher knowledge levels about certain environmental topics than did their classmates.

Future research into this area should focus on not only where children and adults receive their environmental information but on how this information-gathering process is affected by various environmental education programs and how environmental information sources affect environmental knowledge levels. These types of experimental research are needed to help supplement the mostly descriptive work done in this area thus far.

Although some of the research in this area attempted to assess the quantity and quality of the environmental information presented by the media, the few research papers dealing with this enormous topic left many areas about which little is known. The most notable gap in the information base about media presentation of environmental issues occurred in the area of television. The public regarded television as their number one source of information about environmental issues, yet only one of these research papers examined the amount and type of environmental information being presented by this medium. This paper (431) looked at the relationship only indirectly by including 11 television station managers in a survey of media managers that also included 93 radio and newspaper managers who were asked their opinions on environmental issues and their place in the media.

The environmental information content presented by the entire range of mass media, including magazines, newspapers, television, radio, etc., was investigated by only nine of the studies reviewed here. These provide a very limited view of the trends in environmental news reported by these media. Additional research measuring the amount and breadth of environmental information presented by the media would help develop a more complete assessment of this information base. Content analysis studies of the various media should be done along with additional studies measuring the attitudes and opinions of media managers towards covering these issues.

Public Belief Systems Concerning Environmental Issues and Concern about Environmental Issues

The section that investigated concern about environmental issues focused on attempts to determine which of a number of demographic variables have impacts on the environmental concern levels of the general public. The results of these studies seemed to indicate that increasing educational levels were associated with higher levels of environmental concern. Heartening news to environmental educators is the evidence that education has a greater impact on environmental concern levels than a number of variables out of the control of the educator such as social status and residency. Several studies that indicate that increasing age levels may be negatively associated with concern levels may indicate a need for environmental educational materials for a popuulation that may not have been reached by this type of information in its previous educational experiences. The fact that those of a low social status tend to indicate as much if not more environmental concern than their high social status counterparts may indicate a need for the development of special materials for this population that will help them develop the skills to be able to affect environmental change in difficult circumstances.

Several factors influencing the research done in this area thus far makes it difficult to draw many conclusive results about how environmental concern levels vary demographically. The definition of environmental concern and the method by which it is measured must be standardized for the purposes of research in this area, to make results more reliable. In addition, the issue for which concern is being measured must be clearly defined as there is evidence that concern may vary across the issues within a specified cohort.

Public Beliefs and Perceptions about Solutions to Environmental Problems

The research papers that examined public beliefs about solutions to environmental problems clearly indicated that those surveyed, children and adults alike, did not see themselves as part of the solution to environmental problems. This seems to indicate that although current educational efforts may have been successful at making people aware of the existence of environmental issues, they have failed at communicating the human values component associated with these issues.

Although the people surveyed in the research believed that the individual should do something about solving environmental issues, they seemed bewildered when asked to name a specific action they might take. Most people seemed to think that solutions to environmental problems will come from the lawmakers and the scientists, with there being little or nothing individuals can do to affect the outcome of these problems. These results reflect a need for environmental education materials that not only define environmental issues, but explore the effects of human activity on these issues and communicate ways that the individual may play a role in the remediation of environmental problems.

The emphasis placed by individuals on legislative and technological solutions to environmental problems indicates a need for materials that present other types of solutions to those problems.

Most of the research done thus far in the area of solutions to environmental problems has been made up of descriptive studies that asked respondents to choose among a list of possible types of solutions to environmental problems. Additional research like the Neiman and Loveridge (484) study that distinguished between "specific" and "general" support would be helpful in determining if the types of solutions supported by the public in these studies would be the same types of solutions supported by public actions in specific situations. Additional studies that ask for respondents to list possible solutions rather than to choose among given solutions would be helpful in identifying the types of solutions about which the public needs to be more informed. Experimental studies that measure the effects of education about solutions to environmental problems on choices for environmental problem-solving techniques would help guide environmental educators in teaching about these solutions.

Teaching About Environmental Issues: Treatment Effects

In the studies that examined people's beliefs concerning environmental problems, many generalizations were made. However, these generalizations typically were based on a limited number of studies. Further studies involving subjects representing a wide variety of ages and backgrounds are needed. One particularly important question raised by these studies is, "What interplay do the components of the affective domain have with knowledge in increasing an individual's awareness of environmental issues?"

Another important question raised by this body of information is, "What factors are responsible for people's reluctance to accept the idea that environmental problems are serious in their own surroundings?" Is this phenomenon due to a lack of awareness of the seriousness of environmental problems in their vicinity or because of a psychological reluctance to acknowledge serious problems in their own surroundings? Before educators can effectively address local environmental problems, they must first know why people are unwilling to accept local problems as being serious. Studies abstracted by RIEE that examined the effectiveness of instruction incorporating both classroom teaching and field trip experiences revealed that the utilization of both tended to produce greater gains than using only one of the instructional modes. These findings were, however, based on a limited number of studies involving a narrow range of age groups. More research is needed in this area to verify existing research and to examine a greater portion of the population. Further research is also needed to determine the most effective placement of outdoor experiences, i.e. prior or subsequent to classroom instruction.

The use of simulation games to increase participant's level of environmental issue awareness is another area needing more research. Only two studies abstracted by RIEE examined the effectiveness of simulation games vs. alternative teaching strategies. Research is needed to determine if simulation games can produce significantly greater outcomes than traditional classroom instruction in the cognitive domain. Many other variables also need to be examined with respect to simulation games, including age of participant, complexity of the environmental issue, degree of participant involvement, and level of motivation.

Other instructional strategies used for increasing students' awareness of environmental issues are interdisciplinary vs. traditional approaches and values-oriented vs. non-values-oriented approaches. Very little research was abstracted by RIEE in these areas, despite the amount of attention given to these strategies by educators.

V. Environmental Education Research Related to

ISSUE INVESTIGATION AND EVALUATION SKILLS

Peter J. Bastardo[1], Arthur W. Edwards[2], and Louis A. Iozzi[3]

The "Issue Investigation and Evaluation Skill Level" of the "Framework for Environmental Education Curriculum Planning and Development" as presented by Hungerford et al. deals with the development of knowledge and skills to help learners to intelligently investigate environmental issues. The framework as it pertains to this level is, moreover, concerned with developing skills for effectively evaluating alternative solutions for remediating environmental problems.

This chapter has been subdivided into the following sections: Skill Development Related to the Investigation of Issues and Problems, Skill Development Related to the Evaluation of Positions on Issues and Problems, and Skill Development Related to the Identification and Evaluation of Alternative Solutions to Issues and Problems.

Skill Development Related to the Investigation of Issues and Problems

While many of the studies reviewed by the National Commission for Environmental Education Research (NCEER) dealt with and/or utilized the skills needed for investigating problems, few of them dealt with developing those skills in children and adults. Yet this area is considered to be a critical aspect of Environmental Education (EE) by most environmental educators. Thus, Hungerford et al. included developing skills in investigating issues and problems as a major component in their curriculum development framework (131).

Voelker (248) reviewed a large volume of environmental literature designed for children and found that, depending on the year examined, between 40% and 100% of the publications ignored the development of investigation skills in children. It is possible, however, that most (or perhaps all) of the literature reviewed by Voelker was written for younger children and therefore the authors may have considered investigation skill development to be too complex for their audiences.

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Several attempts were made to develop models designed to promote, among other skills, the development of investigation skills. Flitter (98) developed a content analysis model which was useful for analyzing written materials. In another area, Schwartz (213) presented what appeared to be a useful model for helping to explain relationships between birth rates and replacement. Hence, another means of investigating and dealing with data.

Andren (265) argued for the need to include a greater emphasis on problem solving concepts as part of classroom discussions. Thus, he developed and presented a problem investigation/problem solving model that can effectively aid interested people in more thoroughly investigating environmental problems and the nature of their solutions.

Lastly, Iozzi et al. (388) developed the Socio-Scientific Reasoning Model to help children to more systematically investigate problems and to become better problem solvers and decision-makers in a highly scientific and technological age. The model incorporates numerous strategies and provides guidance for developing issue identification skills.

Two studies dealt with evaluating curricula designed largely to develop issue investigation and evaluation skills in children. Hepburn (114) evaluated an interdisciplinary science/social studies curriculum module designed to develop, in part, issue investigation skills in ninth and tenth graders. She found the modules to be effective in promoting growth in cognition as well as in attitudes. Iozzi (133) evaluated Preparing for Tomorrow's World, a curriculum designed to prepare junior and senior high school students to become decision-makers in the high-tech world of tomorrow. This interdisciplinary program deals largely with helping students to develop issue investigation skills and to suggest meaningful solutions to environmental problems. The program was found to be extremely successful with more than 6,000 children in New Jersey. As a result of this "proven" effectiveness, the program was granted official endorsement by both the New Jersey Department of Education and the U.S. Department of Education.

Summary

Few studies have dealt with the issue of developing investigation and analysis skills in children over the past decade or so. The studies conducted to date indicate that a small number of effective models for generating activities and curricula in this area are available. These, however, are far too few to meet the needs of the field of EE.

It is interesting to note that only two studies dealt with evaluating curricula - and both of these studies were interdisciplinary. That is, both of these studies incorporated both science and social studies. While such an approach seems to be in the right direction, much more work needs to be done in this area.

Skill Development Related to the Identification and Evaluation of Positions on Environmental Issues and Problems

In all the studies pertaining to the goals of environmental education, it is readily apparent that environmental education should be interdisciplinary in nature and incorporate affective learning skills. The development of affective learning skills is necessary because they provide the background so important to taking a position on an environmental issue and then defending and "standing up" for that position - often under great pressure from many different interest groups. Knowledge and information are important, but our value systems provide the basis and motivation to take a position on issues.

Henkin and others (383) evaluated curriculum materials that featured social as well as scientific reasoning. These curriculum materials were designed to help students identify and evaluate varying positions on environmental issues. Secondary school students (public and private) enrolled in typical natural- and social-science courses were tested for subject matter knowledge, critical thinking and moral/ethical reasoning. Utilizing experimental and control groups, the investigators were able to show that learning materials of this type have potential to affect skill development in both the cognitive and affective domains. Iozzi (302), utilizing Kohlberg's moral reasoning theory, discovered that the relationship between stage of moral judgement and a given environmental situation is dependent on one's background knowledge of subject, interest (motivation), and concern. According to his research, if a major goal of environmental education is to produce an environmentally-literate public able to make judgements, it is imperative that moral/ethical reasoning and related affective components of learning be included in the learning process.

Real-life simulations are not strangers to the classroom learning situation. However, for the most part, they are not overly common. Some educators feel that simulation activities, especially based on current issues, have strong potential for viable learning experiences, particularly in identifiying and evaluating positions related to environmental problems. Maul and others (397) evaluated a curriculum model, "The Coastal Zone: Man and Nature," in terms of social/moral reasoning, critical thinking, as well as logical and physical reasoning skills. Based on the socio-scientific reasoning model, the simulation leads students through an investigation of continental shelf gas and oil development. The researchers, in their evaluation, address the effectiveness of role-playing, discussions of dilemmas, hypothesis generation and testing, problem-solving, and model building within the context of social/moral reasoning, critical thinking, and logical reasoning skills.

Environmental education has often been misconstrued as a subject relegated only to upper elementary or secondary levels. For the most part this situation has been allowed to occur because of a nebulous definition of environmental education (does it translate as strictly outdoor, recreational, nature or science-related studies?). A majority of environmental educators are proponents of a K-12 curriculum....better still, "womb to tomb" approach, thus removing it from any particular grade level or discipline. As evidence of this interpretation, one study showed that kindergarten children are capable of conceptualizing value positions and responsibility of citizenship concerning environmental issues (40). The investigators determined that pre-school kindergartners are capable of communicating (verbally) positions that are value and citizenship-related. Thus even young children can identify and evaluate positions on issues - even if only at "their own" level.

Courses that have potential for teaching environmental education concepts exist in typical K-12 curricula. One such course is "Problems of Democracy." It should be of interest to proponents of environmental education that since the 1940's, a course of this nature hac primarily focused on issues mainly described in political/social terms and usually outside of the context of environmental impact. However, the potential for incorporating environmental awareness and evaluation of positions on environmental problems in a course of this nature is high, as shown by Voelker and Kolb (250) in a study designed to determine the degree to which 26 social/science-oriented/environmental resource management themes were included in texts often used in "Problems of Democracy" courses.

Six tests representative of those used in Wisconsin schools were selected for examination with the aid of a professional social studies educator. The social/scientific themes, broad in nature, providing the basis for understanding environmental problems were derived from 11 of Roth's 1970 list[1] pertaining to environmental resource management themes. Based on number and percentage of occurrence of pictoral or verbal referrals for each theme, a ranking was established. Four of the eleven themes received 100% ratings by the evaluators:

1. socio-cultural environment,
2. cultural,
3. family, and
4. psychological.

Three other themes involving environmental management techniques and ecology recieved substantial ratings. It is evident from this study that a strong potential for including environmental awareness and position analysis in terms of resources exists in secondary school social science curricula. Similar studies incorporating all fifty states should be conducted in order to help substantiate the importance of the role of social science in teaching environmental education.

Historically, pedagogists have debated about what constitutes learning. In theory, education is comprised of three components: cognitive (factual information), psychomotor (hands-on) and affective (developing and clarifying values and attitudes). The latter has recently come under attack by those who question its role in light of the emphasis placed on SAT scores correlated with a more conservative approach to education. The mid-1970's to the present has witnessed a resurgence of the barrier waves for "back to basics"....who express concern about teaching anything that is difficult to measure. They raise questions about schools presenting material that have potential for involving students in religious, ethical and moral discussions. "Is this what schools are supposed to be teaching?", they query.

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[1] Roth, Robert E., Environmental Management Concepts-A List. University of Wisconsin, Research and Development Center for Cognitive Learning, 1970.

On the other hand there are educators who strongly favor a more holistic development of the child. They feel that schools have an obligation to develop a thinking, concerned citizenry, who upon graduation will be equipped to raise questions, evaluate positions, make intelligent decisions and take a stand on the quality of life in a world which they are inheriting. They suggest that many adults in their role as stewards of the environment hold an overly narrow view of the relationship between people and nature; thus, the environmental dilemmas we currently face. Supporters of a stonger emphasis on values and attitude development look upon this approach as important to reverse or ameliorate environmental trends by "future adults."

Is there a difference between children and adults in the way they perceive the world in which we live? Larson (314) conducted a study of twenty-seven 6th grade students, their teachers and parents to determine differences, if any, between interpretation of man's place in the environment and the role of environment education in the curriculum....extent and teaching approaches. By way of interviews and responses to two environmental values inventories, their study produced interesting results: 1) students did not feel they were nature's masters....in contrast, both parents and teachers held the opposite view; 2) the students' perceptions of their environmental values differed from what the teachers indicated they were teaching, and from what their parents thought they should hold; 3) both teachers and parents recommended a greater emphasis on environmental education in schools and developed criteria for presenting the teaching of values.

People's attitudes are not necessarily carved in stone and can be subject to a variety of forces. Yet most psychologists and educators agree that value and attitude levels begin to form early-on and become the basis for behavior as adults. This is why advocates of values education emphasize early exposure for young people via school curricula. As a case in point Czarnecki (282) surveyed a group of people in the Erie-Niagara region of New York as to their motives for participating in a water quality planning effort. Water is an important resource and much of its use has been wasteful and mismanaged over the years. Would participation be based on a conservation factor? The study's author discovered that the primary reasons for participation were self-interest or "what impact will this have on me?" Water resources was the concern in yet another study conducted by Watkins (253) with a group of highly educated, high income, mostly white-collar adults in two Florida communities whose homes were equipped with many water-using appliances. The author developed a scale to measure and determine attitudes toward water resources. The results of his study indicated that people had not been thinking about trying to conserve, were not concerned about water quality, felt that people have the right to unlimited and free use of water, and that water resources was not a problem at the present time as long as "nature" could solve the supply problem. On the bright side, the respondents felt that people should do something concerning water-related problems.

In the study above, a shortage of water and resulting impact had not actually presented itself. But how differently do people respond in the midst of crisis that is directly affecting them? Hummel, Levitt and Loomis (129), at the height of the 1973 energy crisis, conducted a survey of adult residents in the Fort Collins, Colorado area in which they correlated personal effect, blame and demography with specific behaviors and attitudes, and perceptions of the problem. The results of their study showed voluntary support for pro-energy and air quality-related actions.

It is imperative that educators devise or utilize teaching materials that can help shape student attitudes and develop skills related to the evaluation of positions concerning the environment. Interpretations of mankind's role in the world have often been established in young people by the time they have reached the formative ages, 10-14. The question is, "can these attitudes be re-examined and thus have potential for modification, or in other words....what does it take to bring about a 're-thinking/examination' process?" This is, perhaps, the biggest challenge for teachers working with middle school and junior high youngsters.

Wilson (427) addressed this issue in a 1975 study in which 9th grade students were exposed to materials representing a variety of opinions regarding environmental issues concerning strip-mining (natural resources). Utilizing judges who previously ranked the materials in terms of "strongly supporting vs. strongly opposing," and conducting pre-tests followed by five days of instruction and post-tests with experimental and control groups, Wilson was able to determine that the former group, in general, displayed an attitudinal change....a downgrading of extreme opinions.

Educators, through the ages, have consistently formed the idea that presentation of issues, environmentally-centered or not, is best handled by presenting material that is unbiased in nature....thus students are encouraged to form opinions, develop attitudes based on personal convictions and to take a stance. If this teaching technique is conducted properly, future citizens can hopefully rely on this training to make positive contributions to issues that may affect their life-styles as adults.

School administrators, board officials, teachers and parents need to be concerned that curriculum materials have the potential for substantially contributing to the learning process. Thus, it is essential that new educational materials be able to withstand the scrutiny of evaluators if they are to become established components of school programs. On the surface, a variety of environmental education programs developed during the past decade (1970-1980) hold promise for fulfilling the needs of students to encounter decision-making and attitudinal/value development and clarification. Potentiality and actual results, however, must be closely examined for learning effectiveness in order to determine reliable correlations.

In order to conduct research it is often essential that appropriate measurement instruments be available, or if necessary, developed in order to address a specific study. Iozzi (132) developed the Environmental Issues Test (E.I.T.) in order to determine levels of moral/ethical judgement regarding moral environmentally-associated issues. Using a population consisting of ninth graders, twelfth graders, and college seniors, the investigator was able to conclude that the E.I.T. was a valid, thus useful instrument within the context for which it was designed.

Cheu and others (361) applied the Environmental Issues Test to measure the levels of moral and ethical reasoning associated with dilemmas often encountered in day-to-day living, each centered around a particular environmental issue involving a conflict of moral judgements. Respondents were instructed to prioritize (rate) twelve issue statements based on specific moral reasoning stages derived from Kohlberg's studies. This sort of research is essential if environmental education is to survive as a viable component of the educational process. No curricular material should be automatically accepted on face value, rather it should be capable of withstanding a high degree of critical examination.

Skill Development Related to the Evaluation of Alternative Solutions to Issues and Problems

Developing a citizenry capable of effectively evaluating a variety of alternative solutions to environmental problems and then making the "best" choice from among those alternatives is clearly an important (maybe the most important) goal of environmental educators. Thus, several researchers were interested in exploring this issue; the results of their inquiries are quite instructive and useful.

Dyar (289) examined the views of seventh graders pertaining to environmental problems. The purposes of her research were: (1) to develop an instrument to assess the attitudes and behaviors of seventh graders about aspects of the environment, environmental problems, and possible solutions; (2) to describe and attempt to explain any differences in attitudes and behaviors on the basis of variations in place of residence, sex, scholastic ability, and socioeconomic status; (3) to evaluate the efficacy of the instrument for generating student involvement in environmental education topics; and (4) to make recommendations for future environmental education curriculum development and revision.

A so-called "access" model was derived from the results of Dyar's study. This model suggests that the greater the exposure to relatively clean environments, the more access, both physical and social, to such environments and the more confident the student is of his or her ability to effect change in the environment, the more environmentally concerned and active the student will be.

Recommendations for environmental education curricula based on the study include: creating experience-based programs for raising the general level of consciousness and action regarding solutions to environmental problems; giving more attention to urban and low ability students; focusing outdoor education for urban students both within and outside the urban environment; providing environmental action experiences where success is evident; and increasing the use of affective measures to evaluate outcomes of environmental education programs.

Voelker et al. (249) in their research reported some possible beginning points for environmental education in the school curriculum. They posited that children's responses to environmental problems often reflected a concern for themselves and their families, illustrated by the frequency of personal orientation responses observed for four stories read by selected students in grades 5 to 8. This concern could be a powerful entry point for environmental education curriculum and instruction to assist children in exploring various solution options for EE problems. Student solutions indicated a strong preference for technologically-based improvements of the environment, rather than efforts to change people's attitudes and values.

Many research investigations and professional papers from 1971 to 1982 examined the scope and breadth of programs developed in environmental education. Strojny (338) in 1979 conducted a descriptive investigation of the current scope and trends of exemplary and innovative environmental education curricula throughout the country.

An intensive effort was made to elucidate important themes and instructional strategies related to environmental education curricula: (1) the historical background of environmental education; (2) the concept of environmental education; (3) the interdisciplinary approach in environmental education; (4) values exploration in environmental education; (5) problem-solving processes in environmental education; (6) ecology and environmental responsibility as unifying themes of environmental education; (7) experiential learning in environmental education; and (8) investigating controversial issues in environmental education.

The findings of Strojny's research can be summarized as follows: (1) of the hundreds of environmental education curriculum programs in existence, approximately 200 of the programs indicated some congruence with the selection criteria, and 20 of the programs met all the criteria (interdisciplinary approach, values exploration, problem-solving processes, ecology and environmental responsibility as underlying themes, experiential learning, structure, completeness, continuity, articulation, and generalizability); (2) selected programs originated in 16 different states, and consisted of various combinations of educational levels; (3) selected programs offered a wide range of environmental education curriculum themes that examined diverse ecological processes and environmental issues; and (4) selected programs are characterized by organizational patterns ranging from haphazard structures to comprehensive spiraling strand designs.

Conclusions drawn from the research indicated that the state of the art of environmental education requires some improvement, that a discrepancy exists between recommended and existing program characteristics, that exemplary environmental education curriculum programs do exist to guide program development, and that recent trends indicate positive growth in this field. Included in the recommendations offered by this study are the need for quality curriculum design, program revision, content improvement, and the development of a composite environmental education curriculum content plan.

Childress (278) identified, described, and analyzed five general categories of curricular characteristics of a selected national sample of public school elementary and secondary environmental education programs and project curricula. Specific elements of the study included identification and analysis of selected components and aspects of public school program and project curricula, including grade level participation, program justification and objectives, processes utilized in content selection, curriculum organization, instructional strategies and sources of instructional materials, staff organization and utilization procedures, evaluation methodologies, and constraints to curriculum development.

The study unveiled several findings. Grade level involvement in public school environmental education programs is greatest in grades five, six, ten, eleven and twelve, and least at the kindergarten level. "Educational," "Ecological," and "Conservationist" justifications exert major influences in the development of total program and project justifications in the majority of cases.

According to Childress, program and project objectives were focused more on acquiring knowledge and developing appreciations than on helping students solve environmental problems and develop problem-solving skills. Teachers working in a given program or project were found to have the primary involvement in content selection, while student interest, the personal and social needs of the students, teacher interest, and local environmental problems and concerns were the factors exerting the most influence on the selection of curriculum content.

Iozzi (133) discussed the effectiveness of his program Preparing for Tomorrow's World. The program dealt largely with helping students identify solutions to complex environmental problems. He used a nonequivalent comparison group design as an evaluation method. Two standardized and published instruments were used for moral/ethical reasoning, the Environmental Issues Test and the Defining Issues Test (both Likert-type tests). He reported a significant growth in both cognitive achievement and moral/ethical reasoning in the treatment group in comparison with the control group.

Thiele (339) conducted a study to determine whether written self-instructional activities in ecology could be made more enjoyable and educationally valuable (as operationally defined) for nonscience majors by employing emotionally and aesthetically appealing instructional components.

Major results were: 1) The experimental procedures led to significantly higher ratings ($p < .05$) of emotional involvement and the enjoyability and perceived educational value of instruction. Experimental-control group differences were large enough to be educationally significant; 2) An analysis of attitudinal responses by sex disclosed that in the case of the self-instructional program, females responded significantly more strongly than males; 3) The self-instructional program resulted in cognitive gains which were equal for experimental and control groups; there was no indication that the relatively low cognitive achievement (average gains per class ranged from 12 to 30 percent) was due to the experimental procedures; 4) A comparison of the better and poorer students suggested that achievement did not play a role in determining attitudinal responses to the experimental procedures; 5) The formative evaluation of the experimental approach disclosed a number of specific methods useful in the further improvement of the attitudinal and cognitive effectiveness of the approach.

The study demonstrates a method for introducing emotional and aesthetic experiences into self-instructional activities and suggests that such experiences are an effective means for making such activities appear more enjoyable and valuable to nonscience majors.

Howell and Warmbrod (126) conducted an evaluation 1) of the effectiveness of the student manual Introduction to Environmental Protection in developing students' attitudes toward the protection of the environment among different vocational and science classes; and 2) to investigate the relationships between selected assigned independent variables and class posttest mean scores on the attitude inventory.

The results indicated that there were no significant differences between instructional treatment and control group scores on the dependent variable. However, students in science classes using the manual achieved higher attitude scores than students in vocational agriculture classes using the manual. Results for the identified independent variables tests indicated: 1) a positive relationship between number of professional EE courses completed by the instructor and the students' posttest attitude inventory scores; 2) no relationship between students' posttest attitude inventory score and time used to teach, number of films shown, nor number of experiments conducted in teaching the treatment unit. Finally, students who chose occupations in environmental management tended to score higher on the posttest attitude inventory than students who chose other occupations or who were undecided about such a choice.

Bryant, Covey, and Hungerford (40) reported on their attempt to gather and evaluate data related to the following research questions: 1) Will kindergarten children who have experienced the environment unit identify a significantly greater number of environmental problems than children receiving a control treatment? 2) Subsequent to the identification of environmental problems they perceive as important, will kindergarten children be able to verbally communicate personal responsibilities (value positions) relative to those problems? and 3) Subsequent to the identification of environmental problems they perceive as important, will kindergarten children be able verbally to communicate the responsibilities of other people (value positions) relative to the specific problems? Thirty-four kindergarten pupils were divided into two groups of seventeen children each.

An Introductory Module (IM) was presented to both groups during the first week of the experiment. Subsequently, a modified pre-post rotation design consisting of two phases permitted each group to act as both a control and an experimental group. During the first phase, one group received three weeks of special EE instruction consisting of three segments. The second group received three weeks of typical kindergarten instructional activities. Upon completion of the first phase, the groups were rotated with respect to treatments, and the second phase of the experiment was begun.

The data indicated that kindergarten children can form concepts concerning environmental issues, and citizenship responsibility with respect to those issues. Educational implications were stated.

Two research investigations examined textbooks and children's literature during the 1971 to 1980 period. Wijesinghe (342) identified the quantity and quality of population content in secondary school textbooks in Florida and endeavored to ascertain to what extent such content was utilized by teachers in their classes. The results of the content analysis revealed that though population content was included to some extent in all the textbooks analyzed, it generally was not presented in a systematic manner designed to promote an understanding of population dynamics. Basic demographic data for the world or particular regions of the world were sparse in most textbooks. Key demographic concepts were rarely used or explained. Textbooks almost uniformly gave low coverage or no coverage to certain populations concepts, e.g., rural populations age-sex structure, population and public policy, existent and suggested solutions to population problems, ecological systems and population theories. Population content was found under a variety of topics and was usually given in descriptive, factual form. Generalizations, principles and hypotheses relating to population dynamics were seldom evident. The relevance of population dynamics to the life of the student was rarely made explicit, nor were students encouraged to take an active role in identifying and seeking solutions to population-related problems.

Key recommendations of this study to textbook publishers and teachers are: 1) Infuse population concepts into an increased number of topics in the subject areas identified, 2) Achieve a better balance of population topics, representing the topics identified in this study as receiving low coverage, 3) Present population dynamics in a systematic manner including principles, generalizations, hypotheses and taking an analytic approach, 4) Include key demographic concepts and basic demographic data, 5) Encourage students to see the relevance of population dynamics to their lives, 6) Utilize population materials from reliable sources.

In a similar content analysis study, Voelker (248) attempted 1) to locate a body of literature which would provide a data base for determining the content of children's books related to population problems; and 2) to analyze that literature according to pre-established criteria, notably its nature, focus and concern. The results of the study were discussed in previous sections.

Bennett et al. (354) presented a paper describing P.E.A.C.E. (Project in Environmental Action/Community Education). This research project on environmental education was designed to implement and evaluate a community action curriculum development model concerned with the preservation and enhancement of environmental quality and ecological balance within an urban area. It sought, furthermore, to involve students, teachers, parents, community representatives, school administrators, public school curriculum specialists, and university personnel in all stages of the project. The three objectives of the project were: 1) implementation and evaluation of a developmental curriculum model used to generate effective urban environmental curricula; 2) implementation, revision, and evaluation of the environmental leadership and inservice teacher education modules; 3) implementation, revision, and dissemination of the research findings and recommendations and the revised curricula and instructional program.

Bennett (355) continued his discussion of P.E.A.C.E. in a paper which focused on the development and implementation of the curriculum phase of his urban environmental studies program. The curriculum model developed for P.E.A.C.E. was based on the premises that it should be created by relevant consumer groups as well as educators, comprehensive in scope, and transferable to other segments of society. Project members generated eight instructional modules, a teacher inservice module, and a leadership module. Examples of modules included urban environmental development and planning, social services and the urban environment, economics and politics of resource management, and leisure activities in the urban environment. The modules were field-tested by 24 teachers in 10 urban schools in Memphis (Tennessee). Modules were evaluated by students using various measurement instruments including the module activity questionnaire, the individual module tests, the environmental aptitude scale, the problem-solving process inventory, and the environmental action options scale. Findings indicated that students enjoyed working with P.E.A.C.E. instructional modules and received higher test scores on seven of the eight modules after participating in the project. Findings also indicated that teachers who participated in P.E.A.C.E. inservice training became more knowledgeable about the module topics, objectives and instructional approaches of the project.

In 1979, Andren (265) stated the need for the development of problem-solving skills to aid in the understanding and solving of environmental problems. His study presents a model for problem-solving which is applicable to a wide range of environmental problems as well as data that indicate this model's usefulness. This model consists of 21 questions grouped into six areas of problem identification, historical context, proposing and testing solutions.

This problem-solving model was tested for its effectiveness in increasing environmental awareness by counting the number of generalized statements that referred to interrelationships found in 89 investigative reports on local environmental problems written by students at Montgomery County Community College in Blue Bell, Pennsylvania. These reports were analyzed for items (key words or phrases) and categories (broad areas of environmental interest) in order to measure the breadth and detail of the investigations.

The results of this study showed that the problem-solving model significantly increased the number of categories discussed between the experimental and control group. An increase in the amount of detail (items) was also noted. The analysis of the content of these investigative reports showed that the experimental group discussed economics, law, transportation and population issues to a significantly greater extent than the control group. The categories with the greatest number of items associated with them were (in order of frequency) economics, water pollution, land use, alternatives, government, health, waste water treatment and air pollution. Conspicuous by their lack of discussion were the categories of education, politics, planning and attitudes.

An analysis of the use of the model showed that the students had difficulty in using the parts of the model that dealt with the historical aspects of the problem as well as the testing of proposed solutions. This study also includes an Environmental Awareness Questionnaire developed to measure the students' awareness of environmental interrelationships.

In conclusion, this model was useful in systematically focusing the students' attention on some of the necessary components of environmental problem-solving. The study also indicated that greater emphasis should be placed on problem-solving concepts during class discussion.

Another model which also deals with problem-solving skills is the Socio-Scientific Reasoning Model. This model was discussed in a previous section of this chapter (389, 383).

Peyton and Hungerford (196) attempted to assess the competency level of teachers in environmental action skills. A three-part survey based on a model for environmental action was administered to the participants. The model identifies skills which fit into six different categories, and it lists 13 criteria to be considered when selecting a specific action for an environmental issue. A jury critiqued the instrument; it was revised, and face validity was accepted. The survey was administered by either the researcher or two other trained educators. Monitors observed participants and were asked to note uninterested individuals (those who completed the survey in less than 15 minutes). This group numbered 14, and their surveys were withdrawn. The environmental action competency score (EAC) was assessed to equate the three different groups (college orientation). The results indicated that the population of preservice and inservice teachers was not prepared to help develop environmentally literate students. Therefore, some form of future intervention is necessary. Several ideas for future research were listed.

From 1971 to 1980 a variety of assessment instruments were developed to measure different aspects of environmental education. The range of these instruments included measurements for environmental awareness of energy and water resource options to tests for moral reasoning levels as related to environmental issues. Many dealt with assessing the ability of people to identify solutions to environmental problems.

Passineau (328) conducted a study to develop and validate an assessment instrument, the Environmental Awareness Inventory (EAI), for use by teachers and other evaluators in assessing the "affective environmental awareness" of upper elementary and junior high school students.

Independent scales were constructed for: a) general environmental concern; b) interest in specific environmental issues; c) attitudes towards 14 different issues of environmental quality: population problems, pollution, land-use planning, the energy problem, the development and consumption of energy resources, consumer behavior life styles, transportation systems, recycling and solid wastes, pesticides, wildlife, wilderness, noise pollution, agricultural resource problems, and international agricultural resources; d) degree of faith in the ability of science and technology to find solutions to environmental problems; e) degree of optimism-pessimism concerning one's ability and the ability of others to promote environmental quality; f) degree of environmental activism (motivation to participate in environmental problem-solving activities); g) disciplinary orientation concerning environmental problems and their solutions (aesthetic, political, educational, economic, and technological); and h) degree of recognition of the complexity of environmental problems.

Voelker and Horvat (424) developed an instrument for determining the nature of elementary school children's environmental decisions. This report describes the formulation of a conceptual base for conducting research on elementary school children's orientation toward their environment and details procedures for developing a battery of instruments for measuring these orientations. A definition of environmental orientations is formulated. This definition is used to focus construction of instruments to generate information about elementary and middle school children's orientation towards their environment. Development (pilot and field-test) procedures are presented for three instruments. "Our World of Today/Tomorrow" uses a semantic differential to approximate children's orientation to the present and future world situation. "The Environment and Pollution" uses a Likert scale to approximate student's orientation to general pollution and environmental problems. "The Environmental Decisions Inventory" uses a Likert response format to approximate children's orientation to alternative solutions to specific environmental problems. Estimates of validity, stability, and reliability, and factor analyses are presented.

The Environmental Issues Attitude Defense Inventory (EIADI) was developed by Kinsey and Wheatley (145) to assess the role which information and knowledge have in making value judgments. The EIADI is based on Kohlberg's work and patterned on the Defining Issues Test of James Rest.

A composite score which accounted for differences in group size was arrived at, and used to test for differences regarding value judgments. A nonparametric sign test was used to test for differences regarding information supports. The results of the tests indicate that the prior predictions regarding differences between the two groups were substantiated. That is, the more experienced Conservation and Resource Development students took a more moderate position on value judgments while demonstrating a broad base of information supports.

Further research in assessing moral/ethical reasoning vis a vis Kohlberg was done by Iozzi (132, 361) in 1978 through the development of the Environmental Issues Test (EIT). The Environmental Issues Test is an instrument designed to assess moral and ethical reasoning within a scientific or technological context. It is comprised of five dilemma stories, each of which highlights an environmental issue and the moral conflicts inherent in that issue. Following each dilemma story is a series of 12 issues statements, or problem considerations, each keyed to a specific moral reasoning stage as defined by Kohlberg. Respondents are asked to assign a priority rating to each statement in terms of its relative degree of importance in determining a particular problem solution. The evaluation of the EIT and the development of a similar test for younger students is described. The EIT appears to be a valid, useful instrument in determining levels of moral/ethical judgment concerning environmental moral issues. It can also be useful in a variety of other projects and studies.

Holland (117) examined the views of various political groups. His descriptive research was in the form of a case study. The author presented background information and events associated with the Mayor's solutions to smog problems in the City of Riverside, California. This set the stage for an analysis of the Mayor's behaviors. Background information and events included: population figures for Riverside; portions of a letter from the Mayor to the Governor; an appearance before the U.S. Senate; actions by the State Pollution Control Board; the opening of a natural gas station (i.e., for auto fuel) and accompanying auto conversion facility, an anti-smog campaign and responses to the Mayor by the Chamber of Commerce and state officials.

Analysis of data indicated that the Chamber of Commerce recognized that the Mayor's behaviors could result in unintended effects, including business decline, decline in migration to the city due to its "dirty" reputation, and threats to the then-rising values of housing and property. One actual outcome was the decline in enrollment at the local university. The sought outcome, a decline in smog levels as a result of citizen behavior, did not materialize.

The author closes with a question: Is it sufficient to inform environmentalists what they should avoid doing without communicating what they should do? While the former appears easier, the latter apparently involves yet-to-be developed political insight.

Rickson (201) examined the effects of self-interest on individual beliefs about facts and solutions in environmental quality control. Four hundred and eighty five high school seniors from three schools - urban, suburban- and rural- were given a two-part questionnaire two weeks prior to Earth Day 1970. The author considered the problem areas of Automobile and Population Explosion to be indicative of self-interest, since certain solution statements were in reference to restrictions on personal freedom. The other three problem areas pertained strictly to industry. (Industrial waste, spillage of oil in the ocean and atomic power plants). For all problem areas, the majority of subjects indicated agreement that pollution and population growth are problems, and that steps should be taken to alleviate these problems, usually steps emanating from government control. The agreement was higher for the industry-related areas, but over 70 percent agreed that car owners should be forced to modify their engines to reduce pollution. The author concluded that self-interest motivation had little relevance to the perception of facts and solutions about pollution from automobile use. For population problems, the author found that subject perceptions were in the same direction but not as strongly evident, indicating concern for the individual's right to have children.

Foerstel's (291) study was designed to analyze the congruence of perceptions of and solutions to environmental problems as perceived by respondents from the Knox County and Knoxville areas in Tennessee. This study was restricted to high school seniors, their parents, some of their teachers--and also members of the Sierra Club and National Audubon Society. The total sample was composed of 1,043, of whom 714, or 68.3 percent, responded.

The greatest environmental problem in the study area was "water pollution," closely followed by "solid waste" and "air" pollution. "Erosion" was the least problematic in the study area. In all, only one major ranking inconsistency was noted; despite this, little congruence in ranking was found among the four study groups.

The unanimous choice as most effective "short-term solution" was "Enforcement of existing legislation," with "Public education and information through media" the clear-cut second choice. Little congruence was found among the responses of the four study groups with half of the items reaching at least the .05 level of confidence (chi square analyses).

The most effective "long-term corrective approaches" were "long-range cooperative environmental planning" and "environmental-related research and development" and again little congruence among the responses of the four groups was found. Significant differences in responses were found among 13 of 16 items.

The most effective "change agents" were "long-term planning" and "major crisis" and responses provided by the four groups indicated clearly that little conguence in ranking the 11 items was found.

The major "constraints" to solving environmental problems were "public apathy" and "lack of willingness to pay cost of clean environment," with congruence in responses in only one of 16 items.

"Public information and education through the media" and "public school programs" were rated moderately effective as "short-term" and "long-term" solutions and as "change agents," but were rated very low on the "constraint" scale.

A few researchers have examined how people resolve environmental conflicts and their desire to pay for alleviating these problems. Sanford (208) conducted research to determine if an analysis of the consequences of a proposed roadway project would change the favorability of residents toward the project. Thirteen residents were randomly selected from two randomly identified blocks within the neighborhood of the proposed roadway project. Ten of the selected residents agreed to participate in the study.

Sanford stated that the findings suggested that the consequence analysis procedure was responsible for producing the observed changes in verbal statements, though a causal relationship was not unequivocally established. Data obtained for justification behavior were judged to be higher in overall quality than preintervention statements. The author indicated that the mean increase of 1.3 justifications was not statistically significant. Participants' votes on whether to build the proposed roadway changed for two of ten participants following intervention. Future research might address such issues as who are the most appropriate consumers of such a procedure, what possible consequences should be selected for consideration, and how might citizens educated in this procedure influence decisions affecting their communities.

Stamm (222) discussed new concepts for describing the individual's resolution of environmental policy issues. The author examined previous studies that he had conducted, synthesized the results, and generated hypotheses.

Data collected in three studies supported the idea that the resolution of environmental issues involves the use of cognitive strategies that are situationally determined. The following three variables have emerged from the search for situational explanations. First, that reversal of trends (i.e., a trend toward the scarcity of a resource which should be reversed) is generally a solution that people apply in more than one situation. Yet functional substitution (i.e., a functional substitute for a scarce resource which should be employed) is more often formulated in specific solutions that are perceived to have an impact upon the individual.

Secondly, when the person's self-interest is at stake, a combination of both types of solutions may be evident. Third, the manner in which an individual defines an environmental issue is related to the solution developed.

Sharma et al. (215) investigated the extent to which the public was informed on pollution problems, what they thought about alternative solutions, and what could be learned about problem-solving processes in this community that would be useful to other communities in dealing with pollution problems.

A questionnaire was administered to 225 adults in northern Illinois, and a causal model with four stages was constructed. The model was then subjected to path analysis. Attitudes toward water pollution were obtained through use of factor coefficient weights for the scales in the evaluative factor.

The data suggest that pollution may be less of a political issue than a passing topic of private conversation. Concerns had not crystallized into a coherent movement toward solution. The researchers did not find that the mass media influenced attitudes toward water pollution. Results further indicated that the usual political process and involvement in that process are not effective in generating antipollution sentiment. The authors concluded that much more research is needed.

VI. Environmental Education Research Related to

ENVIRONMENTAL ACTION SKILLS

Jody M. Hines[1] and Harold R. Hungerford[2]

This chapter deals with the development and application of the skills necessary for individuals to take responsible environmental action. In this context, responsible environmental action denotes those behaviors engaged in for the purpose of achieving and/or maintaining a dynamic equilibrium between quality of life and quality of the environment. Developing an environmentally literate citizenry, e.g., citizens who are both willing and able to engage in environmental action, is considered to be the ultimate goal of environmental education (EE). Thus the environmental action component is vital to the actualization of this overriding EE goal for its role in arming individuals with those skills needed to actively engage in responsible environmental behavior.

For the purpose of this research synthesis it is necessary to extend the concept of environmental action beyond its definition of the ability to apply environmental action strategies to real issues. The scope of this synthesis therefore, is broadened to include all related areas of research pertaining to environmentally responsible behavior.

Included in this synthesis is all RIEE research dealing with attempts to encourage individuals to engage in positive environmental behavior, whether in a formal or non-formal setting. Only a small portion of these studies have dealt specifically with the development of environmental action strategies. Instead, most researchers have attempted to alter behaviors by other means such as the offering of rewards to individuals for engaging in responsible environmental behaviors or by simply asking individuals to behave responsibly. Also included in this section of environmental action research are studies which have investigated variables associated with environmentally responsible behavior, as well as a discussion of research methodologies employed in studying environmental action.

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The pages that follow contain brief overviews of the findings of the environmental action research abstracted in Research in Environmental Education: 1971-1982 (RIEE). These overviews are presented under the following major headings:

Predictors and Correlates of Environmental Action

Approaches for the Development of Environmental Action in Formal Settings

Assessment of Environmental Action in Non-Formal Settings

Environmental Action Research Methodologies

It is interesting to note that while one would expect to find a quantity of research devoted to environmental action which is commensurate with its overriding importance in EE, such is not the case. In the presentation of research which follows, the lack of emphasis of research in certain key areas of environmental action is readily apparent.

Predictors and Correlates of Environmental Action

Twenty-seven studies abstracted in RIEE dealt specifically with predictors and correlates of overt environmental behavior. This collection of studies is quite diverse in terms of the nature of the variables investigated in each study. As a whole, these variables fall into the general categories of cognitive, affective, and personality factors (e.g., locus of control and moral reasoning). What emerges from the research is information regarding a wide array of variables associated with responsible environmental behavior.

Borden and Schettino (28) conducted a study using 530 university students in an effort to determine the extent to which factual knowledge and feelings (affect) are related to environmentally responsible action and the degree to which these two predictors are related to one another. The Maloney, Ward, and Brauche Revised Environmental Test was administered. This instrument is comprised of four subscales: (1) attitude toward taking citizenship action, (2) level of actual citizenship action, (3) level of emotionality regarding environmental issues and (4) knowledge about environmental issues. Validity and reliability data on the instrument are presented by Maloney et al. (478, 479). Analysis of data revealed that knowledge accounted for approximately four percent of the variance in predicting environmental behavior, while affect accounted for roughly eight percent of the variance. No correlation between knowledge and affect was found.

In a descriptive study involving 118 female undergraduates from a Japanese women's university, Iwata (465) investigated the relationship between a number of variables and self-reported anti-pollution behavior. His findings indicate that development of an awareness of causes of environmental pollution and insight into consequences of pollution, both of which are knowledge components, are significantly related to anti-pollution. In addition, an appreciation for natural beauty, an affective component, was also found to be related to anti-pollution behavior.

The importance of knowledge in predicting the intention to behave in an environmentally responsible manner was also supported in a study by Geisler (452). He found knowledge of local environmental problems to be a dominant predictor of intention to support local land use policy regulations.

In a descriptive study involving 140 university undergraduates, Dispoto (286) hypothesized a relationship among levels of moral valuing (with respect to the Kohlberg model of moral reasoning) and the variables of self-reported environmental activity, emotionality (affect) and knowledge. His hypothesis was confirmed in that level of moral valuing was shown to be related to these three variables. Contrary to Borden and Schettino's findings, interrelationships among the variables of knowledge, action, and emotionality were also detected. While the strengths and nature of these relationships were not delineated in the abstract, the existence of such interactions suggest that moral valuing, emotionality and knowledge are all variables which are likely correlated with responsible environmental behavior.

Arbuthnot (9) explored the relationships among selected attitudinal and personality characteristics, environmental knowledge, and behavioral commitment using three groups of subjects: (1) users of a community recycling center, (2) members of several conservative, rural churches, and (3) university undergraduates. Using multiple regression analysis techniques to determine which combination of variables would best predict environmental behavior (i.e., recycling), Arbuthnot came up with four predictors of use of recycling centers. These were educational level (beta=.285), environmental knowledge (beta=.424), general conservatism (beta=.605) and external locus of control (beta=-.491). On the basis of these findings, Arbuthnot described a typical recycler as one who (1) is well-informed generally as well as knowledgeable about specific environmental issues, (2) is less bound to past ways of believing and behaving, and (3) has an internal locus of control. Thus personality, attitudinal and knowledge components were shown to be predictive of recycling behavior.

Arbuthnot's findings concerning locus of control as a predictor of responsible environmental behavior were supported in studies by Trigg et al. (244), Tucker (246), and Dyar (289). These researchers found that internal locus of control individuals were more likely to engage in environmental action. Interestingly, Trigg et al. (244) investigated both optimistic and pessimistic individuals and found that optimistic internals were engaged in more anti-pollution activities than were optimistic external locus of control individuals. No relationship was detected between locus of control and anti-pollution activities for pessimistic respondents.

Affective variables investigated in conjunction with environmental action include emotionality, appreciation, attitudes and beliefs. In addition to the Borden and Schettino (28), Dispoto (286), and Iwata (465) findings supporting the relationships between responsible environmental behavior and affective components, studies conducted by Bruvold (39) and by Fischer (450) also support these findings, although these two studies did not assess actual behavior. Instead, they were concerned with individuals' statements of how they intended to behave in the future. Bruvold (39) and Fischer (450) both found a correlation between beliefs/attitudes and intent to behave. Bruvold's findings indicated a correlation of .11 existed between belief and intent to behave and a correlation of .30 between attitude and intent to behave. In this case, intent to behave referred to the degree to which individuals intended to use water reclaimed from domestic sewage. Fischer determined the correlation between concern about overpopulation (an attitudinal dimension) and intention to limit personal reproduction (behavior) to be .70. Thus, a belief that population expansion is potentially dangerous coincided with a desire to restrict one's own reproduction. A discrepancy did arise in the Fischer study in that a similarly high correlation did not appear between concern about overpopulation and desired family size. In this case a negative correlation was found ($r=-.39$). These discrepant results lead one to question the validity of the use of individual's expressions of intention to behave as indicators of actual behavior.

Weigel and Weigel (254) detected a strong positive correlation between scores on a comprehensive environmental behavior index and an attitude scale ($r=.62$, $p<.001$). Attitudinal variation accounted for 38 percent of the variance in the overall pattern of environmentally oriented behaviors assessed (i.e., litter pick-up, recycling, and petitioning behavior). On the other hand, in a study investigating attitude and behavior relationships among residents and college students in a California community, Anderson and Lipsey (8) found no significant relationship between attitude toward technology and energy conservation behavior. Nor was a significant relationship detected between perception of the energy crisis and energy consumption. In reporting his study, Anderson did note that the findings should not be generalized beyond the sample studied, given the size and nature of the sample.

In a quite different type of study, Tanner (230, 231) attempted to learn more about individuals who have committed themselves to occupations in environmental fields. His study was designed on the premise that by retrospectively examining the lives of citizens who have amply demonstrated their informed and responsible environmental activism, information can be gained about the kinds of learning experiences needed to produce such persons. Tanner compiled information on the formative influences which members of several environmental organizations identified as being instrumental in their selection of an occupation in an environmental field. The major formative influences identified were: (1) youthful experiences in the out-of-doors, (2) experiences with pristine environments, (3) parental influences, (4) teacher influences, (5) negative experiences with habitat alterations (e.g., witnessing the commercial development of beloved places), and (6) solitude. Of these formative influences, youthful experience in the outdoors and in relatively pristine environments emerged as the dominant formative influences. A study by Dyar (289) lends support to Tanner's findings. Using a sample of 637 seventh graders, she found that the more access and exposure to relatively clean environments (e.g., wilderness), the more environmentally concerned and environmentally active students will be.

Hummel, Levitt and Loomis (129) carried out a study designed to develop a profile of the environmentally concerned and active individual. Data from an 88-item questionnaire were analyzed using stepwise regression analysis. Nineteen potential predictors emerged from the analysis. In addition to demographic characteristics, the major potential predictor was perceived sources of the energy crisis (e.g., blame). Knowledge of whether an individual believed the energy crisis to be the fault of individual overconsumption or of governmental policies could allow one to successfully predict energy consumption behavior. Persons believing overconsumption of energy by individuals to be at the root of our energy problems tended to manifest energy conservation behaviors.

Larson and Bostian (472) conducted a survey to determine the variety and range of pro-environmental behaviors among a large random sample of the general population of Wisconsin. The results were analyzed separately for pro-environmental activism in the political process (e.g., voting behavior, writing letters to Representatives) and for pro-environmental activism in the household (e.g., buying behaviors, home energy consumption). The researchers found pro-environmental behavior in the political realm to be a much more sensitive and accurate gauge of commitment to working to solve environmental problems than was pro-environmental behavior in the household. Writing a letter to a Congressional representative or contacting a city official indicates a very special, motivated concern whereas buying soft drinks in returnable bottles or not using plastic products might simply be less expensive, more expedient, or habitual (perhaps not even a conscious act). These findings have implications for researchers investigating predictors of environmental action. It may be that in many cases responsible environmental actions being studied are being engaged in for totally non-environmental reasons.

The results of two studies in particular support Larson and Bostian's findings concerning engaging in pro-environmental behaviors for non-environmentally related motives. Becker et al. (433), in studying the relationship between attitudes and residential energy use, found that seven attitudinal factors accounted for 49 percent of the variance in predicting gas consumption behavior. Unfortunately, not one of these seven variables related to conserving for environmental reasons. Instead, factors such as comfort, family finances, health and savings emerged as dominant factors in predicting conservation behavior. The results of a study by Coffin and Lipsey (433) reported in an article entitled "Moving Back to the Land: An Ecologically Responsible Lifestyle Change," revealed that individuals who had moved back to the land, or who had a strong desire to do so, had made the change for a number of reasons, none of which were reported as being environmentally based. Instead, stated motives for changing lifestyles were self-sufficiency, social and family growth, and personal pursuits such as arts and crafts, gardening and religious interest.

The actions reported in these two studies appear to have been taken based primarily upon non-environmentally related motives and illustrate Larson and Bostian's (472) point concerning the problems associated with predicting responsible environmental actions involving household behaviors. The researcher who wishes to predict responsible behavior engaged in for environmental reasons might be wise to avoid assessing household behaviors such as energy consumption and consumerism, as these are likely to be undertaken for a variety of non-environmental reasons.

Additional variables identified in the research as being associated with environmental behavior were self-interest and personal perception of environmental problems (Czarnecki, 282), environmental concern (Kronus and Van Es, 154), political affiliation (Christenson, 60; Dunlap, 82; Van Liere and Dunlap, 499; Dunlap and Gale, 449), personal motivation (Kronus, 153) and a number of demographic variables such as age, gender, educational level and socioeconomic status (Christenson, 60; Dunlap, 82; Tucker, 246; Baca, 269; Neiman and Loveridge, 484; Van Liere and Dunlap, 499).

Summary

Based on the studies reviewed in this section, it appears that:

1. There are many variables indicated by the research as being associated with responsible environmental behavior.
2. General environmental knowledge such as knowledge of environmental issues and knowledge of causes and consequences of pollution were shown to be significant variables in predicting responsible environmental behavior.
3. The affective factors of appreciation of natural beauty, emotionality, concern, beliefs and attitudes appear to be related to responsible environmental action.
4. Personality factors such as level of moral reasoning and locus of control appear to be related to responsible environmental behavior.
5. Persons who have had experiences in the outdoors seem more likely to enter environmental occupations than those who have not had such experiences.
6. In some cases, measures of intention to behave in environmentally responsible ways may not accurately reflect the individual's actual behaviors.
7. The research does not, for the most part, provide a clear picture of the interrelationships which might exist between and among the variables related to environmental action.
8. The research does not provide an indication of which variables are the best predictors of responsible environmental behavior.

Approaches for the Development of Environmental Action in Formal Settings

The studies presented in this section are concerned with the development and use of curriculum and instructional strategies designed to permit or encourage individuals to effectively engage in responsible environmental action. One of the challenges in environmental education is to demonstrate that an educational program can result in positive changes in what students actually do, not simply in what they write on tests. On the other hand, the difficulty of attaining such behavioral evidence must be acknowledged. Eleven studies abstracted in RIEE dealt specifically with aspects of curriculum and instruction related to environmental action. This small number of studies is not indicative of the importance of encouraging responsible environmental behavior in a formal setting. Rather, the lack of studies may be a function of the difficulty of gathering behavioral evidence or of the lack of commitment by educators and by researchers to formal approaches to the development of environmental action.

One of the few experimental studies reported in RIEE designed specifically to investigate the effects of an EE curriculum program on overt environmental behavior was conducted by Asch and Shore (11) using a static group design. Subjects for the experimental group were twelve boys randomly selected from a group of 31 fifth grade boys in a Montreal school. Control group subjects were twelve boys randomly selected from a group of 29 sixth grade boys from a different school in the same city. The experimental group was exposed to a year-long environmental education program consisting, in part, of environmental issue awareness, discussions of the ecological consequences of specific human behaviors and environmentally sound alternatives to such behaviors, values activities, and actual issue investigation (i.e., primarily through use of secondary sources of information). The control group received no exposure to a formal EE program. The dependent variable consisted of the frequency of conservation behaviors engaged in by subjects in both the experimental and control groups. Following the treatment, unobtrusive measures were used to assess the frequency of each group's conservation behaviors on separate field trips. Results indicated that the group exposed to the formal EE program demonstrated significantly more environmentally responsible ecomanagement behaviors than did subjects in the control group. Despite a number of methodological weaknesses inherent in this study (e.g., use of non-equivalent groups and failure to control a number of possible intervening extraneous variables), the study demonstrates the feasibility of successfully employing techniques which measure actual behaviors in a natural setting and that an EE program with the characteristics described in this study can be successful in encouraging certain types of environmentally responsible behavior.

In a quasi-experimental study involving somewhat more rigorous controls, Ramsey, Hungerford and Tomera (489) investigated and compared the educational and behavioral outcomes of two discrete EE methodologies, one directed at environmental issue awareness and the other focused on environmental action training. Subjects in this study consisted of three intact, heterogeneously grouped eighth-grade classes. A pretest-posttest control group design was employed. Independent variables were three distinctly different instructional treatments. One experimental group received environmental issue awareness instruction in a case study format. A second experimental group received environmental action instruction in which students identified environmental problems, identified implicit value positions in environmental problems, autonomously investigated environmental problems, learned environmental problem-solving skills, interacted with the environmental problem-solving model, and applied action strategies to real envrionmental issues. The control group received instruction using a basic science content-oriented text. Dependent variables were students' knowledge of environmental problem-solving skills and students' self-reported overt, independent environmental behaviors, i.e., overt environmental actions that were taken by the student over and above school and classroom activities. Analysis of variance of the pretest measures indicated that no significant differences existed among the three groups on the dependent variables. Analysis of the posttest results revealed that the action group demonstrated a significantly higher knowledge of environmental action strategies ($p<.000$) and engaged in a significantly greater number of overt environmental action behaviors ($p<.002$) than did either the case study or control groups. These findings, based on self-reported student data, were supported by data collected from the student's parents concerning their childrens' environmental action behaviors. No significant differences were detected between the case study and control groups in terms of self-reported overt action behaviors. Thus, it can be inferred that specific knowledge of and a competency with environmental action strategies and techniques foster environmental action behavior. It can also be inferred that environmental awareness instruction alone fails to develop effectively the ability to initiate environmental action.

Lewis (475) reviewed the empirical classroom methodological studies which appeared in the Journal of Environmental Education over the period from 1970-1980. He located seven studies which attempted to measure the effectiveness of formal EE instruction strategies. Only one of these seven studies, the Asch and Shore (11) study described earlier, had responsible environmental behavior as one of its stated goals and attempted to assess the effectiveness of the program based on observed student behaviors. The remainder of the instructional strategies reviewed dealt primarily with knowledge or attitudinal dimensions.

While not directly addressing curriculum and instructional strategies for environmental action, the studies summarized in the remainder of this section have implications for the formal arena. For the most part, these studies either dealt with key goals and characteristics of EE related to environmental action or attempted to assess teacher competencies in environmental action skills.

Peyton and Hungerford (196, 331), surveyed a sample of preservice and inservice teachers in an attempt to determine their environmental action competencies. An instrument was designed based on a paradigm of environmental action which operationally defined five categories of environmental action and identified thirteen criteria for selecting appropriate environmental actions. Findings indicated that most of the population sampled actually had little competency in the environmental action skills assessed by the instrument, perceived that they had little competency in these skills and had limited experience in environmental action-taking. Peyton and Hungerford suggest that without some future intervention (e.g., training, curriculum materials) there is little reason to expect the assessed sample, or a similar sample, to effectively prepare environmentally literate students in their classrooms.

In another survey, James and Potts (468) assessed the status (practices) and goals of environmental education in Kansas. They sampled seven groups of individuals (n=957) comprised of school administrators, teachers and EE specialists. Listed among the perceived priorities of state EE specialists were so-called innovations such as incorporating overnight camping into EE programs and the use of programs which meet on non-school days. Lower ranking was given to the importance on developing skills in solving environmental problems. No support was voiced among those individuals assessed for responsible environmental action as a primary goal of EE in Kansas.

Somewhat different findings emerge from the results of a survey conducted by Hart (459). He examined the EE literature published between 1966 and 1978 in an effort to identify the key characteristics of environmental education. Among the 25 key EE characteristics identified were problem-solving and active participation. To be considered a key component of EE, the characteristic must have been stated as a core element in EE by at least one major conference or workshop, by at least ten individuals writing in refereed journals and by at least ten individuals writing in articles abstracted in RIEE or in books. Thus, contrary to the James and Potts (468) survey, active participation in preventing and solving environmental problems does appear to be a desired key characteristic of EE among many environmental educators.

Kochan and Allen (471) developed a set of basic energy competencies for the energy-literate adult based on a statewide survey of active energy educators in Florida. Of the 25 energy competencies identified by the sample, only three of these related directly to energy consumption behaviors. While overall the participants agreed that conservation behavior was the most pressing response to our energy situation, the suggeted competencies involved primarily knowledge and attitude components. Kochan and Allen suggest that this finding reflects the "academic falacy" that one must master information before one can perform practical application. The authors are critical of energy literacy and energy competency which become transformed into "knowing." They note that "we too easily forget that competency has to do with doing, acting, performing...knowing how must not be overwhelmed by knowing what."

Summary

Based on the studies reviewed in this section, it appears that:

1. Before instructional approaches to environmental action can be successfully implemented in schools, appropriate pre- and inservice training must be initiated to develop teachers competent in designing and implementing instructional strategies for environmental action.

2. It is possible to successfully design and implement instructional strategies which result in desired behavior changes in individuals (e.g., in the development of environmentally responsible citizens who are able and willing to take action).

3. Instructional strategies based solely on knowledge and awareness of issues, while an important component, are not sufficient to lead to the development of environmentally active individuals.

4. Key components of a curriculum designed to develop environmentally active individuals appear to be:

    a. Knowledge of:
        (1) environmental issues
        (2) ecological consequences of human behaviors
        (3) environmentally sound alternatives
        (4) environmental action strategies.

    b. Skill in:
        (1) clarifying values
        (2) investigating issues
        (3) environmental problem-solving
        (4) application of action strategies to real issues.

5. There is a lack of research emphasis in the formal school setting toward curriculum approaches to the development of environmental action.

Assessment of Environmental Action in Non-Formal Settings

A large portion of environmental action research reported in RIEE (40 studies) falls in the category of approaches to environmental action in a non-formal setting. A non-formal setting includes any setting outside the realm of the traditional classroom. Thus, studies conducted in a non-formal setting may involve children visiting a nature center or zoo, customers at a grocery store, or individual households. Although these studies took place in a wide variety of settings, there are a number of similarities among the studies included in this category.

All of the studies reported in this section employed some type of behavior modification technique in attempting to bring about environmentally responsible behaviors. Specifically, these behavior-modification techniques can be categorized into groups of studies which provided individuals (1) with positive or negative reinforcement, (2) with verbal or written appeals, (3) with a rationale for engaging in the desired behavior, or (4) with feedback. In addition, all of these studies focused on ecomanagement behavior. Ecomanagement behavior refers to any physical action taken by an individual aimed directly at maintaining or improving the existing ecosystem. This includes such behaviors as energy conservation, litter pick-up, and recycling.

Reinforcement Techniques

Research on the effects of positive reinforcement on individual's ecomanagement behaviors reveal extremely consistent findings. Results of studies by Burgess, Clark and Hendee (43, 61, 62), Chapman and Risley (58), Everett, Hayward and Myers (92), Foxx and Hake (101), Hayes, Johnson and Cone (112), Kohlenberg and Phillips (149), Kohlenberg, Phillips and Proctor (150), LaHart and Bailey (156), McNess et al. (170), Powers, Osbourne and Anderson (197), Witmer and Geller (257), Foxx and Schaeffer (451), Jacobs et al. (467), and Slavin, Wordarski and Blackburn (493) all indicate that providing positive reinforcement in the form of money or other material inducements led to desirable behavioral changes such as recycling, reductions in driving, decreased electrical energy consumption, and non-littering behaviors. No contradictory results were found in that all studies investigating the effects of providing monetary or other reward incentives resulted in behavioral changes in the anticipated direction, although in only one of these 15 cases were levels of significance reported in the abstracts.

Negative reinforcement techniques have also been found effective in encouraging individuals to take part in ecomanagement behaviors. Marler (175) conducted a study in a national forest campground and found that the threat of punishment (i.e., fines) for littering was even more effective in reducing littering than were methods of positive reinforcement. In this study, strict monitoring of campsites occurred in that each campsite was checked for litter before campers were allowed to check out of the campground. A study by Van Houten (498) showed that negative reinforcement in the form of increased inconvenience led to decreases in energy usage. Van Houten, using an elevator door delaying device, found that the longer the delay, the greater the decrease in elevator usage. Agras (1) studied water consumption levels in the periods before and during the 1977 California drought. In this case, the imposition of fines was shown to lead to decreased water usage by private homes. Interestingly, the largest water savings occurred during the two months prior to the imposition of fines in the area, indicating that other variables were affecting water savings.

Written or Verbal Appeals

Research has been conducted investigating the effectiveness of written or verbal appeals in inducing individuals to engage in environmentally sound ecomanagement behaviors. The research findings in this area indicate that the effectiveness of these procedures varied depending on the targeted behavior and the form of appeal employed. Results of studies employing verbal or written appeals in attempting to reduce littering (LaHart and Bailey, 156; Chapman and Risley, 58; Hayes, Johnson and Cone, 112), to encourage households to reduce their electrical energy consumption (Delprato, 74; Luyben, 166, 477) and to recycle newspapers (Reid et al., 199; Witmer and Geller, 257) all revealed that such appeals had little or no effect on subjects' behaviors. On the other hand, posters and flyers, both forms of written appeal, were shown to be effective in inducing individuals to turn out lights in unoccupied rooms (Delprato, 74; Luyben, 166) and to purchase soft drinks in recyclable containers (Geller, Farris and Post, 106). These particular studies for the most part did not offer rationales for the intended behaviors as part of the treatment. In each case the treatment consisted merely of encouragement to engage in the behaviors.

Providing Rationales

Several researchers investigated the effects of educational information on ecomanagement behaviors. Such information was intended to provide individuals with a rationale for engaging in the intended behaviors. In a study by Kohlenberg, Phillips and Proctor (150), subjects were given information concerning electrical energy peaking problems. It was hypothesized that providing subjects with such knowledge would lead them to curb their energy usage during peak times of the day. Results indicated, however, that the information condition had little effect on changing subjects' energy usage behavior. LaHart (156) also investigated the effects of information on ecomanagement behavior. In this pre-experimental study involving 903 elementary school children visiting a local nature center, he found that brief instruction employing educational materials or lectures did not appear to reduce the amounts of litter left along a nature trail.

Abbott (352) found similar results in his assessment of a year-long series of newspaper articles about energy. No specific changes in readers' energy-related behaviors could be linked directly to the reading of the series' articles, although pre- and posttest scores indicated significant increases in subscribers knowledge of energy and energy-related issues. Contrary to these research findings, research conducted by Schnell et al. (210) investigated the effects of an anti-litter newspaper campaign and found that the campaign did in fact lead to significant reductions in litter in the targeted areas. However, the effects produced were of a temporary nature only, in that after publicity ceased, litter levels returned to pre-study levels.

Providing Feedback

Research investigating the effects of feedback on ecomanagement behaviors, specifically energy consumption, revealed mixed results. Four separate studies (Palmer, Lloyd and Lloyd, 190; Seaver and Patterson, 214; Hayes and Cone, 460; Winett et al., 502) each found that providing households with frequent feedback concerning their energy consumption levels sizably reduced levels of energy usage, while Kohlenberg, Phillips and Proctor (150), in a similar study, found only slight reductions following feedback. Unfortunately, these behavior changes did not appear to be long-lasting. Hayes and Cone (460) noted that upon withdrawl of the feedback, energy consumption levels of study households returned to levels even higher than pre-study levels.

Summary

Based on the studies reviewed in this section, it appears that:

1. A large body of environmental action research has been devoted to non-formal approaches of encouraging individuals to engage in ecomanagement-related behaviors.

2. The most effective way to encourage ecomanagement behavior appears to be to give those behaviors a value. Thus, the incentive system seems to be more effective in inducing ecomanagement behavior than are more traditional methods, such as appeals to citizenship.

3. Negative reinforcement (i.e., fines) appears to be quite effective in bringing about individual ecomanagement behaviors in situations where strict monitoring and enforcement occur.

4. The effectiveness of behavior modification techniques, such as feedback, verbal/written appeals and knowledge, varies depending on the type of issue involved.

5. In terms of energy consumption, it appears as though short-term consumption by households can be affected by frequent feedback on household consumption levels.

Research Methodologies

In reporting the findings of studies presented in the preceding sections, no attempts were made to describe or evaluate the rigor of the research conducted. Yet, there are several indicators which can provide an over-all picture of the research quality. These indicators include research design and methodologies, and the extent of the literature cited.

Table 1 contains data pertaining to research designs employed in the environmental action research broken down into the same three categories of studies in which the findings were presented. Classifications were made based on Isaac and Michael's scheme for research designs outlined in the Handbook in Research and Evaluation, 1979.

TABLE 1

Research Designs Employed in Environmental Action Research

	Categories of Studies			
Research Design	Predictors and Correlates	Formal Settings	Non-Formal Settings	Total
True-Experimental	0	0	1	1
Quasi-Experimental	0	3	7	10
Pre-Experimental	0	0	21	21
Historical	0	2	0	2
Descriptive	24	2	3	29
A. Correlational	7	1	0	8
B. Survey	7	1	2	10
C. Survey-Correlation Combination	10	0	1	11

Large differences in research design are evident in comparing categories of studies. This is not surprising by any means, as design decisions depend on the purposes of the study, the nature of the problem, and the alternatives appropriate for its investigation. Descriptive studies are the most appropriate means of attaining information on the predictors and correlates of responsible environmental behavior. What is distressing is the large number of pre-experimental designs employed in investigations of non-formal approaches to environmental action. Studies employing pre-experimental designs are plagued with internal validity problems. Due to a lack of control in the pre-experimental design, extraneous variables can confound the effects of treatment variables. Because of the complete lack of a control group, no provision for comparison exists except implicitly, intuitively and impressionistically. Thus, even with a great deal of care given to the collection of data, conclusions can only be impressionistic and imprecise. While pre-experimental methods may be useful in exploring for researchable problems or developing ideas or devices, as in action research, they are not a basis from which defensive conclusions in research can be derived. In designing experimental studies in the future, researchers should attempt to employ methods which will diminish internal validity threats (e.g., by inclusion of a control group and by randomization).

A portion of the text of a well-prepared research report should be devoted to establishing the significance of the research question or questions. This is normally accomplished by appropriate literature citations. One would, therefore, expect researchers to cite a number of references in reporting their work. Table 2 provides a summary of this information. Only a small portion of studies (n=3) cited no references. Thus, overall this does not appear to be a major weakness of the research reported in this synthesis.

TABLE 2

References Cited*

	Categories of Studies			
Number of References Cited	Predictors and Correlates	Formal Settings	Non-Formal Settings	Total
0	1	1	1	3
1-5	1	2	6	9
6-10	1	2	11	14
11-15	4	2	7	13
16-20	4	0	3	7
>20	9	0	3	12

*Table 2 does not include number of references cited in dissertations.

Discussion

The body of research presented in this synthesis provides a great deal of information concerning environmental action. Despite the fact that the research studies were organized and presented in three separate sections [(1) environmental action predictors and correlates, (2) environmental action in formal settings, and (3) environmental action in non-formal settings], there exists an interconnectedness among many of the studies in these sections. In several cases, the research from one section lends support to or provides valuable information for researchers interested in other avenues of environmental action research. For example, there are, or should be, close ties between research devoted to predictors and correlates of environmental action and research related to the development of environmental action curriculum, in that knowledge of the predictors and correlates of environmental action should provide an indication as to what the components of that curriculum should be.

The findings presented in this synthesis indicate that a curriculum focusing on the development of participatory citizens would likely include facets which address cognitive, affective and personality factors associated with responsible environmental action. In addition, studies undertaken in classroom settings point to a skill component (e.g., issue investigation skills, problem-solving skills, environmental action skills) as an additional requirement for the development of environmentally active individuals. The cognitive and skill components lend themselves especially well to education in formal settings. But affective and personality factors are not so readily addressed. Sensitivity, appreciation, concern, beliefs, locus of control, and level of moral reasoning are not typically addressed in formal educational settings. This may be due to a lack of knowledge as to precisely how these factors can be altered in individuals in this setting. In any case, an effective environmental action curriculum is likely one which addresses a wide array of educational domains, only one of which is the cognitive. Additional knowledge of the variables associated with responsible environmental action should aid greatly in determining the components of an effective environmental action curriculum.

Curriculum development becomes further complicated due to a lack of more detailed knowledge concerning the predictors and correlates of responsible environmental behavior. It is not known how these variables interact with one another, nor are the relative strengths of the associations among these variables and responsible environmental action known. Without this knowledge, it is unclear whether effective environmental action curricula should emphasize knowledge components, affective components, some other aspects, or combination of factors. There may be an optimum mixture of affective, cognitive (including skills), and personality factors which, when combined in the proper proportions, predispose individuals to action. Factors not yet addressed by environmental action research efforts may also play a role. In any event, additional research is required before such a determination can be made.

It does, however, appear that knowledge alone, while significantly correlated with responsible environmental action, is not sufficient to predispose individuals to attempt to remediate environmental problems.

Yet, many EE curricula appear to be concentrating on knowledge components or measuring program effectiveness based solely upon knowledge gained by students. This is reported to occur even in instances where responsible environmental action is the stated goal of particular EE programs. Thus, this is one of the more serious problems plaguing EE. Exceptions are the Asch and Shore (11) and Ramsey et al. (498) studies. These studies illustrate the feasibility of achieving the ultimate EE goal of responsible environmental action by efforts in a formal setting. Further, these two studies attempt to assess actual student behaviors as indications of program effectiveness rather than relying solely on measures of knowledge gained by students.

Perhaps the problems associated with existing environmental action curricula stem from a lack of acceptance and/or commitment to responsible environmental action as the overriding goal of environmental education. An awareness of the importance of this goal must be developed among teachers and curriculum developers Appropriate preservice and inservice training must also be initiated to ensure competency by teachers in developing and implementing strategies for environmental action in the classroom.

Studies undertaken in the non-formal realm do not appear to be as closely tied with the research on predictors and correlates of environmental action as is the research in formal settings. Knowledge does appear to be effective in altering behaviors in some, but not all, instances. Thus, in non-formal settings, knowledge appears to have a connection with responsible environmental behavior, but that connection is variable depending on the issue in question. Affective and personality factors have not been widely investigated in environmental action studies in non-formal settings. This may be a result of overall mode of investigation.

The majority of the environmental action studies in non-formal settings which were reported in RIEE employed experimental or pre-experimental designs where some treatment was implemented with the intention of altering individuals' behaviors. The treatment variables in many of these studies were factors which were easily manipulated, e.g., providing rewards, feedback, punishments, educational materials or appeals to responsible citizenship. Consequently those treatment variables which are the simplest to administer appear to be the most widely researched. In addition, those behaviors which are most readily observed appear to be those which are most widely researched. These primarily include observations of littering behavior and energy consumption via examination of household energy bills.

One of the most interesting, and perhaps most distressing, factors which comes from the synthesis of studies undertaken in the non-formal realm are the motivations which emerge for individuals engaging in particular actions. Many of the environmental actions studied by researchers in non-formal settings appear to have been undertaken for non-environmental reasons. Payment for engaging in particular behaviors or punishment for not behaving in a specified manner does appear capable of altering behaviors. Yet, these types of behavior modification approaches raise questions for which there are no easy answers. For example, should an action be classified as an environmentally responsible action when it is engaged in solely for the monetary rewards to be gained? Is it preferable that individuals be motivated to behave in a positive environmental manner based on knowledge, skills, and a sense of responsibility to the maintenance of a quality of human life for all of mankind, rather than for selfish motives? Or, is the underlying motivation irrelevant? Where the requisite knowledge, skills, and sense of duty are lacking, are behavior-contingent rewards and punishments the only effective methods remaining which can assure that environmentally responsible behaviors are practiced by the general public?

Perhaps answers to these questions cannot be formulated without additional research. Yet, the research called for must in many cases take a different focus in terms of the types of environmental problems which are being studied. For example, 33 percent of the studies reported in the non-formal section dealt with littering behavior. The environmental problems which are today threatening the stability of our ecosystem are not those concerning littering in a movie theater or park. Litter studies seem rather insignificant in light of environmental problems which seriously impact on humanity and the environment. Perhaps research efforts should be redirected to address more significant and overriding environmental problems.

VII. Environmental Education Research Related to

TEACHER TRAINING

R. Ben Peyton[1]

The need for expanded and improved teacher training in Environmental Education (EE) at preservice and inservice levels has been documented by Wilke and Leatherman[2]. They reviewed literature which showed that the few U.S. colleges of education which require environmental education stress environmental science as opposed to methods of teaching EE. Similar findings have been reported for Canadian schools (236). Studies of inservice teachers generally indicate that teachers are not trained to prepare environmentally literate students, nor are teachers themselves competent in all aspects of environmental literacy.

The purpose of this review was to focus on research which evaluated inservice and preservice training methods. Sixty-one abstracts were examined and 19 were found to be suitable for inclusion in this chapter. These 19 studies were analyzed to gain insight into the quality of research in the area of EE teacher training and the types of training strategies which are effective in producing desired changes in teachers and their students.

Abstracts from Research in Environmental Education, 1971-1982 were first identified by the descriptors "teacher training", "teacher inservice," and "teacher preservice." These were examined and evaluated using the following criteria:

1. The paper had to deal with methods for training EE teachers.

2. The paper had to report some form of research (e.g., historical, descriptive, experimental, quasi-experimental).

Thirty-nine of the papers were dismissed because they did not deal directly with EE teacher training strategies. An additional three teacher training papers were dismissed because they did not report research. The remaining 19 papers were analyzed.

The papers were analyzed to determine type of research, experimental design, method of treatment, variables and implications of findings for EE teacher training strategies.

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[1] Associate Professor, Department of Fisheries and Wildlife, Michigan State University, East Lansing, 48824-1222.

[2] Wilke, Richard J., and John Leatherman, "Conclusions and Generalizations Drawn from 'Research in Environmental Education 1971-1980' Regarding Teacher Training Preservice, Teacher Training Inservice, Community Resource Use, and Field Trips." In A. B. Sacks, et al. (eds.) Current Issues in Environmental Education and Environmental Studies Volume VIII, pp. 199-207. Columbus, OH: ERIC/SMEAC, 1983.

Training Strategies

Journal papers gave few details of the educational method being tested. Generally, educational experiences can be categorized as preservice courses (n=4), inservice programs including symposia (n=1), audio-tutorial workshops (n=1) and general workshops (n=12). Those workshops for which length was reported ranged in time from one hour (86) to 90 hours over nine months (453).

Brogden and Rowsey (37) used four interdisciplinary activities from the "Students Toward Environmental Participation" (STEP) program (National Park Service) with prospective teachers in science and social studies. They measured only the participants' attitudes towards the activities and found no difference between the teachers of science and the teachers of social studies.

Andrews (267) reported that preservice elementary school teachers who were exposed to a values-oriented environmental education unit had significantly better attitudes towards environmental concepts than control teachers.

Two studies looked at the effectiveness of including EE in science methods courses. Jaus (138) gave the experimental group a unit on environmental science (i.e., concepts of ecology). This group was also required to develop activities for a problem-solving EE curriculum (K-8) and to design and carry out a science experiment dealing with an environmental problem. It was found that the treatment group possessed significantly greater positive attitudes toward teaching EE in their classrooms than did the control group which was exposed to a non-EE science methods course. Bluhm and Hungerford (27) showed that preservice teachers could learn basic ecological concepts and improve their ability to define environmental education when these topics were covered in a science methods class.

Milson (180) measured the effect of a symposium on secondary teachers' attitudes. The symposium included presentations by environmental scientists on topics of air, water, noise pollution and other environmental problem areas. Findings indicated secondary teachers enjoyed the symposium, increased their knowledge of natural resource concepts, and changed their opinions concerning procedures for selecting content for the classroom.

Impacts of workshops on participants varied from no change at all to improved attitudes, knowledge, and behavior. A comparison of structured group discussions led by a trained leader with unstructured discussions during an audio-tutorial EE workshop showed no differences in attitude change between groups (305). Two studies investigated the use of resource guides by EE teachers. Participation in the development of resource guides coupled with training in the use of these guides was found to increase knowledge of, attitude towards, and use of resource guides over simply providing the guides as teaching resources (104, 344). An evaluation of a one-hour workshop using an energy simulator teaching machine reported 96% of the subjects already knew about energy problems and 88% felt the individual could contribute to solving these problems. Accordingly, the evaluator found improvement on a few items but no change in most as a result of using the simulator. All other workshop evaluations showed some gain in teacher knowledge, attitudes and/or behaviors (125, 165, 233, 234, 240, 404, 453, 454).

Four studies were included which investigated the impact of teacher workshops on students taught by those teachers. Andrews' (267) use of a values-oriented environmental education unit produced significantly more positive environmental attitudes in elementary students as well as in the teachers who taught them. Wileman (343) found an environmental education project for teachers produced differences in their fourth, fifth, sixth, and eighth grade student attitudes and knowledge, but found no conclusive differences in teachers. Hounshell (125) evaluated the impacts of a workshop which included both sixth grade teachers and their students. The workshop involved teachers in five days of instruction and materials planning. This was followed by a supervised and assisted classroom implementation of the ideas and approaches learned during those five days. Students were pre- and post-tested with the Environmental Knowledge and Opinion Survey (EKOS). Teachers were assessed by three instruments covering attitudes, knowledge and behavior. Teachers and students showed significant gains on all dependent variables.

Secondary teachers attending a six-week workshop demonstrated a similar influence on their students' scores on a water pollution control information test, the Verbal Reasoning Test, and on the Numerical Ability Test of the Differential Aptitude Tests (233). The workshop provided teachers with understanding of water pollution control problems and offered the opportunity to consider means for integrating the topic into their curricula.

Teacher Characteristics

Several abstracts were not included in the 19 reviewed because they described teacher characteristics (e.g., attitudes, behaviors, background, etc.) rather than teacher training strategies. However, some of the findings have implications for teacher training and a brief review is provided here.

A study of Wisconsin teachers (57) assessed their comprehension of and responsibility for teaching accepted goals of EE. Most teachers comprehended the goals and felt they were important. There was also a perceived need that workshops would be necessary to prepare classroom teachers to achieve the goals. A study of Kentucky teachers (301) also revealed an endorsement of EE. Over two-thirds of the responding teachers believed EE should be taught by schools. However, only one-fourth believed it was their own responsibility to teach it. Perceptions varied with subject areas taught, but not with age of respondents. Teachers in this study also supported a need for inservice EE programs for teachers. Similar support for interdisciplinary, "value laden" programs was reported for high school science and social studies teachers in Minnesota (455).

Teachers in the Midwest were found to perceive environmental studies similarly to environmental educators; to be concerned about the environment and to be predisposed to teach environmental studies (307). The environmental teaching activities most often selected by the teachers (e.g., litter pick-up, animal care) were characterized by: teaching moral values, being simple to do, providing immediate and obvious feedback, and being relevant to students. Constraints to teaching environmental studies most often mentioned were inadequate academic preparation, lack of time, student personal problems and limited teaching materials.

A study of Indiana teachers (358) found that with the exception of science teachers, Indiana teachers possess inadequate environmental knowledge and awareness. In another study, teachers sampled in Illinois, Missouri and Kentucky were found to have little competency in environmental action skills (331). These teachers also perceived this lack of competency, had limited experience in environmental action-taking, and had few plans for future involvement as environmental activists.

Generally, these and other descriptive studies point to a low level of preparation of teachers to implement EE. On the positive side, some awareness of EE and an accepted responsibility to achieve EE goals is present. The studies provide little guidance as to how to improve the situation, however.

Research Quality

The pre- post-test control group experimental design was most frequently reported (n=10). Three of the 19 studies reported a post-test-only measure using two or more randomly selected groups. Three studies used pre-post measures of a simple group and three studies reported post-only measures of two or more non-randomly selected groups.

Most researchers developed their own instrumentation (n=12). Seven of these reported reliability and validity procedures and results. Five other studies used previously developed instruments for which reliability and validity had been established.

These results with a narrow group of studies may be put into perspective by comparing them to Wilke and Leatherman's broader survey of reports relating to EE teachers or teacher training. Wilke and Leatherman found 70% of the abstracts in this topic area were indicated as descriptive research. Only 20% were experimental, the rest being pre-experimental or theoretical. They also found needed information on reliability and/or validity was omitted by researchers in at least 25% of the reports which should have contained that data.

Evidently, research concerning teacher education is representative of research in some other aspects of EE. Lewis (475) reviewed articles in the *Journal of Environmental Education* from 1970-80 which dealt with research on instructional strategies. He found that reports omitted critical data, studies lacked methodological rigor and the validity of many studies was questionable.

Recommendations

This review of research on the effectiveness of preservice and inservice EE teacher education indicates that some form of training can produce desired effects on teacher attitudes, knowledge, and behavior. More importantly, there is reason to state that such training impacts favorably on students taught by those teachers. Results seem to be enhanced if teachers are allowed to participate in the development of classroom materials.

Perhaps the most important aspect of this review is the identification of what is lacking from research in this area. Even the positive generalizations above must be accepted with some caution due to weaknesses in design and analysis. Improved student achievement, for example, may be an artifact of the special circumstances of the evaluation. Would teachers try so hard and students cooperate so well, if they were not being evaluated as part of the study? These and many other such limitations exist in the reported research.

Most discouraging is the lack of attention given to curriculum design and reporting of educational methods used in the studies. No theoretical constructs were being tested by the researchers. No basis was given for selecting most of the teaching strategies used in the studies. All the literature indicates is that when you teach teachers, they learn, and, fortunately, so do their students. What we do not know is which methods provide greatest results in cognitive, affective and/or psychomotor domains. Few principles for designing EE experiences come forth from the research to provide guidance in preparing courses or workshops. What key components should be included in a training experience to produce the most effective changes in participants? How much involvement and time are required to produce maximum effects and efficient use of training resources? A strong research base will need to attend to these and many other such questions.

An organized approach to the question of how best to improve teachers' ability and willingness to achieve EE goals is greatly needed. In addition, the quality of reporting by the EE community in the *Journal of Environmental Education* and other journals must be improved. It does the profession little good to learn that a one-week workshop produced changes in teaching behaviors, if no one can replicate the effective components of the workshop.

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